Build Fact Fluency
Through Real-World Contexts
and Purposeful Practice

By Graham Fletcher
& Tracy Johnston Zager

Visit Booth 501 or scan the QR code to request more information.
All Regional Conference presentations will be held at the Indiana Convention Center. See pages 57–59 for floor plans.
Welcome to Indianapolis!

Thank you for joining us in Indianapolis! An amazing team of volunteers has worked diligently to plan this conference for you. Whether you are a preservice teacher, new teacher, experienced teacher, administrator, instructional coach, teacher educator, researcher, or have some other creative connection to NCTM, you will find sessions, workshops and bursts selected to inspire you and help you hone your craft!

Each presentation aligns with one of six strands. Across the six strands, we made sure to highlight the importance of access, equity, and empowerment to both teaching and learning. These strands, along with the presentation descriptions, are intended to help guide your choices.

Are you new to NCTM? Experienced teachers are excited to share their classroom tested and approved strategies and insights with you. Are you a veteran NCTM attendee? Isn’t it amazing how you can always glean a new insight and walk away with renewed energy from each and every NCTM conference? Is this your first in-person conference since the pandemic began? We believe this conference will offer you the opportunity to refresh, reflect, and reconnect.

While you are here in Indianapolis, be sure to explore! You could take a stroll to Monument Circle or even explore the Central Canal by land or by paddle boat. There’s unique shopping in Fountain Square and plenty of nightlife in downtown Indianapolis. Indianapolis also has a thriving culinary scene with dozens of restaurants within walking distance of the conference.

Finally, and most importantly, thank you for being here. Thank you to the conference volunteers and staff for devoting your time and talents in order to provide quality professional development for the mathematics education community. We are doing important work during this challenging time. We hope you leave this conference with renewed energy, new ideas, and with human connections that will help you continue to facilitate high-quality mathematics teaching and learning for each and every student.

Benjamin Sinwell
PROGRAM COMMITTEE CHAIR
Pendleton High School
Anderson, South Carolina

Rick Hudson
VOLUNTEER COMMITTEE CHAIR
University of Southern Indiana
Evansville, Indiana
New and Preservice Teachers Workshop

Wondering how to manage your classroom, work with parents, find engaging lessons, and handle homework—all while keeping your sanity? You’re not alone! A must for every new teacher, this interactive workshop is your chance to ask questions on topics of your choice. Plus, you will connect with other new and early-career teachers. If you are in the first five years of teaching or are seeking certification, come get resources, materials, and fun prizes to encourage you and give you insight along your journey.

Thursday and Friday, Presentations 30 and 130
9:45 a.m.–11:00 a.m.
Room: Thursday – 236, Friday – 236

Types of Presentations
All presentations are open to all conference participants. Admission is on a first-come, first-served basis. Reserving spaces in line or saving seats is not permitted.

Sessions (60 minutes) represent a common format during which speakers relate their ideas to an audience. Rooms are either theater style or classroom style and vary in size.

Workshops (75 minutes) are rooms set with round tables for hands-on work.

Bursts (30 minutes) are presentations that focus on a specific topic or idea. Rooms are set with round tables. The goal is information sharing, conveyed quickly and succinctly.

Exhibitor Workshops (60 minutes) are opportunities for exhibitors to showcase their products and services away from the Exhibit Hall. Look for the symbol indicating exhibitor workshops in the program book.

Grade Bands
To help you find appropriate presentations to attend, each presentation lists the presentation’s target grade-band audience:
- PreK–Grade 2
- Grades 3–5
- Grades 6–8
- Grades 8–10
- Grades 10–12
- Higher Education—university- and college-level issues (including both two-year and four-year institutions)
- Research
- Coaches/Leaders/Teacher Educators
- General Interest—issues of interest to multiple grades and audiences

Overview and Orientation
Whether you’re new to NCTM or a seasoned veteran, there is something new at the conference for everyone! Hosted by members of the Board of Directors, this session will show you how to maximize your overall conference experience. Learn all the new, innovative aspects this year’s meeting is showcasing or discover something you’ve missed in the past. Find out how to navigate presentations, learn how to use the conference app, and network with other attendees.

Thursday and Friday 7:15 a.m.–7:45 a.m. Room: 241–242
Focus Strands

**COLLABORATING AND ENGAGING WITH TOOLS AND TECHNOLOGY**
Tools and technology have been particularly relevant as we navigate among in-person instruction, distance learning, and various combinations of the two. We’ve had to reimagine the role of tools and technology to consider how we can leverage them to bring quality instruction to each and every student in new ways, no matter how they are joining the classroom. Presentations in this strand will bring innovative ideas for using tools and technology as a means of supporting effective instruction, collaborating with other professionals, engaging students with one another, assessing student learning, and building and maintaining relationships with students and families.

**ACCESS AND EQUITY BOTH REVEALED AND REVISITED**
How are we creating inclusive classrooms that allow all students access to high-quality mathematics? By implementing equity-based teaching practices and advocating for the empowerment of each and every learner to experience school mathematics as a whole person, we can dismantle barriers—especially for those who have been marginalized by race, class, ethnicity, socioeconomic status, or gender. Presentations in this strand will highlight how to build student agency using resources such as technology to employ, establish, and foster parental involvement; encourage the use of cultural and linguistic resources; build a student’s mathematical identity through self-advocacy in an online/virtual environment; and promote access for each and every learner of mathematics. Presentations and sessions may also examine how educators can dismantle inequitable structures and replace them with policies and practices that broaden the purposes of learning mathematics.

**JOY OF TEACHING, LEARNING, AND DOING MATHEMATICS**
How can we strengthen our love of mathematics by engaging in and learning new mathematics? How can we rekindle the joy of teaching for us, which in turn will help our students find joy in learning and doing mathematics? Many of us chose to teach because of an influential teacher who taught us at one time, or because of the joy and satisfaction we received from doing mathematics. Presentations in this strand will highlight mathematical learning for teachers, with sessions focusing on engaging teachers in active problem solving, reasoning and proof, encouraging communication, and exploring connections and representations. Presentations may or may not find their way into the classrooms of the teachers but are intended to embed teachers in a culture of questioning and problem solving, and toward refilling our “mathematical cups.”

**TEACHING AND LEARNING IN THE CURRENT ERA**
How have your instructional practices changed or grown as a result of the pandemic? What lessons have you learned about effective mathematics instruction that have led to transformational changes you will continue after the pandemic? Creating effective learning environments for each and every student requires implementing research-informed and equitable teaching practices. Presentations in this strand will discuss mathematical teaching practices while highlighting classroom-tested activities that allow each and every student to engage with and find success in mathematics. To promote deep mathematical learning, presentations may include the following: goals to focus learning, high-level tasks, robust assessments, connections and mathematical representations, effective questioning strategies, productive struggle, and technology that supports visualizing and comprehending mathematical ideas.

**BROADENING THE PURPOSE OF MATHEMATICS**
Now more than ever, our students need mathematics to make sense of the world. NCTM’s Catalyzing Change series calls us to “empower each and every student with deep mathematical understanding and positive dispositions toward mathematics that support interactions with mathematics throughout life” (Catalyzing Change in Early Childhood and Elementary Mathematics: Initiating Critical Conversations, p. 11). Fostering the wonder, joy, and beauty of mathematics is imperative as we cultivate the mathematical mindset students need to understand and examine the world around them. Presentations in this strand will highlight ways in which educators “situate the learning of mathematics not only as important for college, career, and life but also as a human endeavor that values historical, cultural, and aesthetic perspectives of mathematics” (p. 11).

**LEVERAGING ASSESSMENTS TO PROMOTE STUDENT LEARNING AND IMPROVE INSTRUCTIONAL PROGRAMS**
This strand highlights the different purposes of assessment in mathematics teaching and learning. Presentations in this strand will address how assessment can be an integral part of instruction to promote student learning, ways in which assessment can provide evidence about all components of students’ mathematics learning—including strengths and intellectual gifts—and ways in which assessment can provide an accurate picture of teacher and student performance. Presentations may also address the role of technology in assessment, the use of formative assessment in the classroom, the way assessment can inform program improvement, and strategies to overcome unintended consequences of assessment.
Insightful Education Sessions, Dynamic Exhibits

NCTM Regional Conferences & Expositions are an opportunity to share knowledge and learn with leaders in mathematics education. Gain new strategies to unleash the mathematical mind of each and every student.

- Improve your knowledge and skills with high-quality professional development and hands-on activities.
- Connect and share with peers from throughout the region.
- Collect free activities to engage and excite your students.
- Explore an exhibit hall packed with exciting learning and giveaways.
- Learn from education leaders and test the latest educational resources.

You will walk away with the following:

- Innovative ideas you can immediately use
- Updates on classroom best practices from recognized innovators
- In-depth discussions about the latest education resources
- Knowledge-sharing with like-minded peers
- Interaction with the latest tools and products in the Exhibit Hall

Tips for a Rewarding Regional Conference & Exposition

- Access the conference app for program and speaker information, to connect with other attendees, and to share your feedback. Visit nctm.org/confapp.
- Get available speaker handouts at nctm.org/planINDY.
- Keep the conversations going, connect with other attendees and speakers, access and share session resources, ask questions, and more in the MyNCTM online community at my.nctm.org/INDY2022.
- If you’re experiencing the conference with your colleagues, attend different presentations and share ideas with one another after the conference.
- Silence your cell phone during presentations.
- Be safe! Remove your name badge when you leave the conference facilities.

Registration and Access to Presentations

Registration will be located at the Indiana Convention Center in Exhibit Hall JK. You must wear your badge to attend all presentations and to enter the NCTM Exhibit Hall. You will need to show a picture ID to have your badge reprinted.

By registering and attending an NCTM conference, meeting, or other activity, participants grant NCTM the right to use their likeness or voice as recorded on, or transferred to, video, social media, photographs, websites, electronic reproductions, audio files, and/or other media of such events and activities.

For Your Child’s Safety

During installation and dismantle, no one under the age of 16 will be allowed in the Exhibit Hall. Due to the size and professional nature of the conference, and for your child’s safety, children under the age of 16 are not permitted in the Exhibit Hall during show hours. Exceptions to this rule will be made for nursing mothers and their infants.

Information Booth

The Information Booth will be in the Indiana Convention Center. Staff can answer your questions about Indianapolis and assist you with directions and local information, from transportation and historical sites to shopping and entertainment. In addition, you may retrieve or turn in lost-and-found items at the Information Booth. Unclaimed items will be turned over to Indiana Convention Center Security.

First-Aid Station

There will be a first-aid station at the Indiana Convention Center during the conference. If you need medical services while in Indianapolis, please check with the hotel concierge for the closest medical facilities. For any medical emergency, call 911 without hesitation.

Presentation Handouts

Attendees can access available electronic presentation handouts through the conference app and online planner at nctm.org/planINDY. Handouts will be available for one month after the conference ends.

Program Updates

Visit nctm.org/INDY2022 for program updates, including all the latest changes, cancellations, and additions. You can also follow along with the conference app to view event alerts and up-to-the-minute information.
Exhibits
Make time to visit the Exhibit Hall. The hours allow ample opportunity to explore, test, and purchase resources for your classroom. You’ll also be able to meet product specialists, get fresh ideas, and watch demonstrations on how products will help you in your classroom. We’ve provided dedicated time to visit the exhibits; no presentations will take place from 12:00 p.m. to 1:00 p.m. on Thursday and Friday. Check out the map of the Exhibit Hall on page 57 and the list of exhibits on pages 59–61.

Exhibitor Workshops
Do you want more in-depth, personal interaction with exhibitors? If so, plan to attend the Exhibitor Workshops. These workshops are held on Thursday and Friday and offer a wide variety of topics. For exhibitor workshop offerings, look for presentations in this program marked with the symbol.

NCTM App
Start planning early and stay connected throughout the event with the NCTM mobile app. Whether you have an iPhone®, iPad®, Android™, or tablet, the app is your onsite sidekick! Get the app and select your event to access these features and more.

- Notifications—View event alerts and up-to-the-minute information.
- Schedule—Search sessions and speakers, create your own itinerary, download handouts, take notes, and make personal appointments.
- Exhibitors—Search, filter, take notes, and contact and mark exhibitors to visit.
- Directory—Create your own profile and search for and message other attendees.
- Maps—View floor plans and maps.

Visit nctm.org/confapp for more information.

Online Conference Planner
The Online Conference Planner is a great way for you to search the conference program book, set up your personal schedule, and download available presentation handouts. The Online Conference Planner is continually updated with the latest presentation changes and information. Visit nctm.org/planINDY to check it out.

Wi-Fi
Complimentary wi-fi will be available for NCTM Regional Conference & Exposition attendees throughout the Indiana Convention Center.

- Username: NCTM
- Password: NCTM2022

Infinity Bar
Experts will be available to talk to individuals or groups of teachers about issues related to mathematics education. You will be able to sign up in advance to speak to an expert at a designated time.

The BOOKSTORE at NCTM Central
Check out the totally redesigned, and cashless, bookstore at NCTM Central. Shop NCTM’s newest titles, best-sellers, and math-themed products for great gifts and incentives. Get your Notice and Wonder merch here! Save 25% off list-price books and free shipping* on all books purchased through the Online Bookstore. Preview at nctm.org/catalog.

NEW! Get customized NCTM Regional Conference apparel printed right in front of you! Select the design, color, and style that’s uniquely you! Notice and Wonder tees—Regional Conference hoodies—so many colors and styles!

*Discount and free standard shipping are limited to NCTM Indianapolis 2022 Regional Meeting Badge Holders who purchase as individuals from the online NCTM bookstore from March 16 through March 18, 2022. Free shipping limited to the contiguous United States. Discounts and free shipping do not apply to purchase orders.

Note on sales tax exemptions: To be considered exempt from sales tax in the NCTM Bookstore, you must provide a copy of a Indiana tax exemption certificate at the time of purchase. NCTM is required by law to keep a copy of the certificate; we cannot return it to you. To qualify, you must pay with a purchase order, check, or credit card from the school to which the Indiana exemption certificate is issued. NCTM cannot accept personal checks, personal credit cards, or cash in conjunction with tax exemption certificates. Tax exemption certificates for states other than Indiana are not valid for this Regional Conference.

Contactless Payments
As part of our health and safety protocols, NCTM will provide contactless payment options at NCTM registration, the NCTM Bookstore and NCTM Central. Accepted credit card payments will include any US- and most internationally-issued magstripe or chip cards bearing a Visa, Mastercard, American Express, or Discover. Checks may be accepted for exact amount at registration only. All payments are to be made in United States Dollars (USD$). No cash payments. Please check with individual exhibitors and sponsors for their onsite payment policies.
NCTM Central

Make your meeting experience complete with a visit to NCTM Central in the Exhibit Hall during exhibit hours.

- **Wednesday** 4:00 p.m.–6:00 p.m.
- **Thursday** 9:00 a.m.–5:00 p.m.
- **Friday** 9:00 a.m.–2:00 p.m.

Learn how NCTM supports you and the field of mathematics education:

- Get sample journals and more at **Member Services**. Take the opportunity to update your membership information and learn about your benefits.
- Discover available funding and resources to support you in your career and professional development through the **Mathematics Education Trust (MET)**.
- Check out **Classroom Resources** and learn about NCTM’s collection of lesson plans, problems, and more.
- The **Networking Lounge** is a prime location to meet up with colleagues between presentations! Whether you want to make connections with fellow conference goers, exchange teaching tips, or catch up with friends, you’ll find a comfortable spot in the Networking Lounge. Relax and recharge—make use of charging stations while you reflect with colleagues.
- Learn about NCTM’s **Professional Development** offerings. Information will be available about NCTM’s Professional Learning Services and upcoming Regional Conferences & Annual Meetings.
Coronavirus Health & Safety Tips

- Wear a mask that covers your nose and mouth
- Maintain proper social distancing of 6 feet/2 meters
- Wash your hands often
- Use hand sanitizer
- Avoid shaking hands, high-fives, and hugs
- Clean your electronics
- Use your own supplies
Opening Session: The Teacher Scale. How Do You Measure Up?

Indiana Convention Center, Sagamore Ballroom 3

Have you ever found yourself asking, “Am I a good teacher?” What was your response, and what criteria did you use to come to that conclusion? Let’s reflect on what high-quality teaching looks like and redefine the “good teacher” narrative. This will be an opportunity to reconnect and rebuild our respective mathematics communities through intentional, guided self-reflection.

Laila Nur, LAUSD-Division of Instruction, Los Angeles, California

Regional Conference Overview and Orientation

Workshop

Indiana Convention Center, Room 241–242

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Dewey Gottlieb, Board of Directors, National Council of Teachers of Mathematics, Reston, Virginia; Hawaii Department of Education, Honolulu
Twitter: @dewgott

Jennifer Suh, Board of Directors, National Council of Teachers of Mathematics, Reston, Virginia; George Mason University, Fairfax, Virginia
Twitter: @completemath

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Broadening the Purpose of Mathematics
Leveraging Assessments to Promote Student Learning and Improve Instructional Programs
Thursday Morning Sessions

3  Helping Students Discover Mathematical Moments
   PreK–2 Session
   Indiana Convention Center, Sagamore Ballroom 4
   Mathematical moments can be found in everyday activities within a child’s environment. This session highlights embedding PreK–2 NCTM Process Standards into the day of a young child. Participants will develop an understanding of developmentally appropriate ways to enhance mathematics instruction at school and in the home.
   Jeanne White, Elmhurst University, Illinois

4  Empowering Young Math Modeling Sleuths to Solve Problems
   3–5 Session
   Indiana Convention Center, Room 231
   This session will present an instructional strategy used to engage K–6 students in mathematical modeling to solve school and community problems while connecting to students’ lived experiences. We will share modeling tasks that engage students in problem formulation within their local contexts, empowering them to draw on their funds of knowledge.
   Jennifer Suh, Board of Directors, National Council of Teachers of Mathematics, Reston, Virginia; George Mason University, Fairfax, Virginia
   Susan Call, Westlawn Elementary, Falls Church, Virginia
   Kristen Burke, Westlawn Elementary, Falls Church, Virginia
   Brett Terrell, Westlawn Elementary, Falls Church, Virginia

5  Using the Ancient Board Game Go (Weiqi, Baduk) to Enhance Math Learning in Elementary Classrooms
   3–5 Session
   Indiana Convention Center, Room 232
   The ancient and still widely played Go game covers about 60 percent of the K–grade 3 content in the math learning standards. Participants will learn to play the game of Go and different ways teachers have used Go to support students to meet the Common Core State Standards for Mathematics in two elementary classrooms. They will also explore the benefits of game-based learning.
   Xiuwen Wu, National Louis University, Skokie, Illinois
   Xinming Guo, Go and Math Academy, Chicago, Illinois

6  Enriching Algebraic Reasoning with Activities and Games
   6–8 Session
   Indiana Convention Center, Room 245
   This session will focus on strategies to develop problem solving and generalization skills to prepare the early algebraic thinker conceptually for algebra. Weekly algebra readiness problem-solving activities will be shared. We will model the classroom climate and discuss strategies to implement these algebraic reasoning activities.
   Kenny Evans, School City of Hobart, Portage, Indiana
   Michael Maesch, Michigan City, Indiana
   Amy Asher, Union Township Schools, Valparaiso, Indiana
   David Feikes, Purdue Northwest University, La Porte, Indiana

7  Misconceptions versus Gaps: Creating Intentional Pathways to Readiness Success
   8–10 Session
   Indiana Convention Center, Sagamore Ballroom 3
   As educators, we look at data and identify students’ misconceptions, knowledge gaps, and readiness for a math course; but then what? Join the discussion as we look at strategies to focus on each student’s mathematical needs and how to enact differentiated just-in-time intervention for grade-level success.
   Sarah Galasso, Carnegie Learning, Anaheim, California
   Twitter: @SarahGMath

8  Preparing for the Calculator Active Questions on the Multiple Choice AP Calculus Exam
   10–12 Session
   Indiana Convention Center, Room 240
   Let’s prepare all students to be successful on the calculator active multiple-choice questions by accessing a variety of technology tools while having students apply mathematical thinking, reasoning, and communication. TI graphing tools will be used in this session.
   Kimberley Thomas, Moon Valley High School, Phoenix, Arizona
   Twitter: @Kim_math

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9
Secondary Mathematics in a Flipped Classroom Environment
10–12 Session
Indiana Convention Center, Room 205
In this presentation, attendees will have a multilevel view of a flipped classroom model to understand design strategies for their own instructional goals. From tips to filming lessons to tracking student progress, attendees will have an opportunity to access and navigate learning progressions as both student and teacher.
Robert Mayne, Chariho Regional High School, North Stonington, Connecticut
Twitter: @RobertMayne74

10
Broadening Math Learning Opportunities through Family Engagement: Using Family Funds of Knowledge
General Interest Session
Indiana Convention Center, Room 239
School-family partnerships increase academic achievement, positive attitudes, and students’ career pursuits. These activities highlight parents’ power and role in teaching essential skills for students’ math success. Many parents have rich life experiences, critical thinking skills, and cultural knowledge—regardless of their level of education.
Alan Zollman, Indiana University Southeast, New Albany
Twitter: @AlanZollman

11
Building Thinking Classrooms
General Interest Session
Indiana Convention Center, Sagamore Ballroom 5
In this session, we look at the research into how teachers can transform their classrooms from a space where students mimic to one where students think. The practices discussed will intertwine with the recently published book Building Thinking Classrooms in Mathematics (Grades K–12): 14 Teaching Practices for Enhancing Learning.
Peter Liljedahl, Simon Fraser University, Burnaby, British Columbia
Twitter: @pgliljedahl

11.1
Solving2Succeeding: Building Problem Solvers for Tomorrow (Grades K–5)
3–5 Exhibitor Workshop
Indiana Convention Center, Room 130
Focus on building students’ problem solving and critical thinking skills with a progressing series of problems aligned to key math skills. Experience hand2mind’s year-long, daily routine of problem solving for grades K–5 that allows students to successfully solve and understand multistep problems in any situation!
hand2mind, Vernon Hills, Illinois
<table>
<thead>
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<th>Workshop ID</th>
<th>Title</th>
<th>Room/Location</th>
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| 12         | How Do I Promote Productive Struggle in My K–2 Mathematics Classroom? | PreK–2 Workshop, Indiana Convention Center, Room 241–242 | Together, we will explore specific actions to help K–2 students begin to see why struggle is important for them as learners of mathematics. We will also consider how we can support students as they engage in struggle to make it productive. Practical ideas to use in classrooms will be shared.  
Susan Katt, Lincoln Public Schools, Nebraska  
Twitter: @susiekatt |
| 13         | Multiplication for Every Age                                         | 3–5 Workshop, Indiana Convention Center, Room 236 | Too often as teachers, we focus on what we are teaching this school year . . . and that’s about it. How often do we critically look at what students are learning outside of our grade band? In this session, we will follow the progression of multiplication as a concept and a skill from the foundations in kindergarten through algebra 2.  
Shelby Strong, Self/Stronger Math Consulting, Gretna, Louisiana  
Justin Aion, Environmental Charter School, Pittsburgh, Pennsylvania |
| 14         | Tools for Assessing (Real) Math Fluency                              | 3–5 Workshop, Indiana Convention Center, Room 208–209 | Math assessments often focus on accuracy only, but assessing fluency must attend to efficiency and flexibility—for example, being able to select an appropriate strategy. Join me to explore a collection of assessment tools and ideas that truly focus on fluency—from basic facts to multidigit whole numbers to fractions and decimals.  
Jennifer Bay-Williams, University of Louisville, Pewee Valley, Kentucky  
Sherri Martinie, Kansas State University, Manhattan |
| 15         | Transform Tasks to Bring Curiosity, Surprise, and Joy into Math      | 6–8 Workshop, Indiana Convention Center, Room 233 | Curiosity, surprise, and joy—three words most students (and teachers) don’t associate with math class. Let’s change that! Learn four simple frameworks proven to transform boring, routine tasks into rich, open tasks that spark curiosity, surprise, and joy for all. Rediscover how amazing school math can be!  
Raj Shah, Math Plus Academy, Powell, Ohio  
Twitter: @drrajshah |
| 16         | Where Am I? Formatively Assessing Student Spatial Awareness Using GeoGebra 3D and Augmented Reality | 6–8 Workshop, Indiana Convention Center, Room 243–244 | Augmented reality (AR) is a new technology that can now be found on most phones and tablets. We will use GeoGebra 3D Calculator to build models of physical solids using coordinate and transformational geometry. We will then use AR on our devices to test the accuracy of our virtual models by superimposing them over the real ones in our environment.  
Timothy Brzezinski, Wallingford Public Schools, Connecticut  
Twitter: @TimBrzezinski |
| 17         | Engaging Secondary Students in Social Justice Mathematics: Reflections of Novice Teachers | 8–10 Workshop, Indiana Convention Center, Room 234–235 | Session participants will complete a social justice mathematics task. We will then facilitate a discussion of participants’ experiences and share our reflections from a participatory action research study focused on engaging our secondary students in social justice mathematics lessons.  
Camryn Adkison, Student, West Lafayette, Indiana  
Isabelle Miller, Student, West Lafayette, Indiana  
Alexis Grimes, Student, West Lafayette, Indiana  
Michael Lolkus, Purdue University, West Lafayette, Indiana |
| 18         | Experiencing the Joy of Math on the Floors of Buildings in San Francisco, Dallas, London, and Abu Dhabi | 8–10 Workshop, Indiana Convention Center, Room 204 | Architecture is a field in which teachers can build a sense of joy for their students one floor at a time. It is a place where students can appreciate the beauty of math. This is especially true when students explore math in buildings that have unusual shapes where the floor space, number of windows, and so much more varies from the ground up.  
Ron Lancaster, University of Toronto, Hamilton, Ontario |

**Thursday Morning Workshops**  
8:00 a.m.–9:15 a.m.
Thursday Morning Workshops

19 Desmos eTools: Using Interpretive Feedback to Build Conceptual Understanding
10–12 Workshop
Indiana Convention Center, Room 237–238
How can dynamic representations be designed to enable students to evaluate and refine their thinking? Join us to learn how eTools built on the Desmos graphing calculator can be designed to provide interpretive feedback. We’ll explore how eTools can be used to develop conceptual understanding and discuss design considerations when creating your own.
Claudine Margolis, University of Michigan, Ann Arbor
Twitter: @cmars585

20 “Counting” on Quantitative Reasoning: A Combinatorial Approach to Algebraic Identities
10–12 Workshop
Indiana Convention Center, Room 206–207
Students should be able to reason abstractly and quantitatively (SMP 2). But what does quantitative reasoning look like in secondary courses like algebra 2? Together, we will solve a problem sequence that develops algebraic identities from quantitative and combinatorial reasoning and supports proficiency with expanding and factoring.
Lori Burch, Indiana University Bloomington, Bloomfield
Erik Tillema, Indiana University Bloomington
Andrew Gatza, Ball State University, Muncie, Indiana

Thursday Morning Sessions

22 Using “Stuck Points” and Equitable Practices to Develop All Students into Effective Problem Solvers
PreK–2 Session
Indiana Convention Center, Room 245
How do teachers help students who get “stuck” without telling them what to do? Why are “stuck points” celebrations for learning? Come learn about effective and equitable teaching strategies to engage all students in persevering while problem solving. See these ideas in action in class videos and walk away with strategies you can use immediately.
Danielle Curran, Curriculum Associates, Reading, Massachusetts
Twitter: @danigirl1216

24 Using Virtual Manipulatives to Engage Students in Deep Mathematical Exploration and Discovery
6–8 Session
Indiana Convention Center, Room 232
Manipulatives can transform how students make meaning of important ideas by making abstract relationships visible, by teaching creativity and problem solving, and by allowing students to explore and discover. Learn how virtual manipulatives can mirror these effects and support more complex interactions that are not possible in the physical world.
David Poras, Weston Public Schools, Mathigon, Massachusetts
Twitter: @davidporas

25 Developing Mathematical Literacy through Young Adult Literature
8–10 Session
Indiana Convention Center, Sagamore Ballroom 3
Reading young adult literature in mathematics classrooms can motivate students’ learning and enhance mathematical understanding. Students can solve math problems posed in the text as a way to consider the possibilities of mathematics in their world and future. We share lesson plans for teaching mathematics concepts through young adult literature.
Holly Anthony, Tennessee Tech Univ, Cookeville
Paula Greathouse, Tennessee Tech Univ, Cookeville

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27. Using Simulation to Informally Develop the Logic of Statistical Inference
   10–12 Session
   Indiana Convention Center, Sagamore Ballroom 4
   We will show how activities involving simulation can build on student intuition and provide a framework to enable a conceptual understanding of the logic of informal statistical inference. We will do this with tactile and computer simulations using two real studies, one involving a single proportion and one comparing two proportions.
   Todd Swanson, Hope College, Holland, Michigan
   Jill VanderStoep, Hope College, Holland, Michigan

28. Using a Questioning Technique to Promote and Assess Mathematical Inquiry
   Coaches/Leaders/Teacher Educators Session
   Indiana Convention Center, Room 239
   Remote teaching is challenging enough, but engaging undergraduate students in mathematical and STEM inquiry poses additional hurdles. Asking probing questions to evoke discussion about a particular problem is often met with dead silence. Two professors will show how the question formulation technique (QFT) improved student engagement and learning.
   John Somers, University of Indianapolis
   Twitter: @JohnSomers2013
   Gaoming Zhang, University of Indianapolis

29. Using the Digital Platform ASSISTments to Enhance and Support Your Mathematics Teaching
   General Interest Session
   Indiana Convention Center, Sagamore Ballroom 5
   Learn how ASSISTments, a free online tool, enhances teachers’ curricula by providing students with immediate feedback and teachers with actionable data they can use to monitor progress and target instruction. ASSISTments is currently used by 20,000+ teachers, including 251 Indiana teachers who have already created 9,687 assignments in our platform.
   Cristina Lindquist Heffernan, The ASSISTments Foundation, Worcester, Massachusetts
   Twitter: @cristinaheff
   Brian Story, ASSISTments, Worcester, Massachusetts
   Dawn Peterson, The ASSISTments Foundation, Worcester, Massachusetts

29.1 Accelerating Math Growth: Support Grade Level Practice and Unfinished Learning w/ Freckle K–12
   Coaches/Leaders/Teacher Educators Exhibitor Workshop
   Indiana Convention Center, Room 130
   Increasingly, educators are being asked to accelerate learning. What does this mean? Basically, it means helping students master grade level content and skills while also helping them to master unlearned, prerequisite skills. In this workshop you’ll explore how Freckle Math makes this not only possible but easy and enjoyable as well.
   Renaissance, Indianapolis, Indiana
**Thursday Morning Workshops**

**9:45 a.m.–11:00 a.m.**

**30** New and Preservice Teachers Workshop
*Workshop*
Indiana Convention Center, Room 236
Find answers to your questions on topics such as classroom management, parents, motivation, and keeping your sanity. Connect with other new teachers, learn from experienced professionals, and find resources to engage you and your students. You might even win a prize!
*David Barnes*, NCTM, Reston, Virginia

**31** Figuring out Fluency: Beyond Facts and Algorithms (Elementary)
*PreK–2 Workshop*
Indiana Convention Center, Room 237–238
Fluency is complex. Teaching it well is challenging. Teaching it equitably is nonnegotiable. This session examines what procedural fluency is and what it isn’t. It addresses myths, strategies, and assessment. It establishes what we must do to teach fluency equitably. Participant learning will be complemented with ready-to-use classroom resources.
*John SanGiovanni*, Howard County Public School System, Westminster, Maryland
Twitter: @JohnSanGiovanni
*Jennifer Bay-Williams*, University of Louisville, Pewee Valley, Kentucky

**32** Implementing Effective Questioning Strategies and Mathematical Discourse to Advance Achievement
*3–5 Workshop*
Indiana Convention Center, Room 233
Are you seeking effective questioning strategies, applied to complex, real-world problems, leading to advanced achievement for every child? Learn how to design instruction that addresses every child’s learning needs, where thinking is visible, student feedback informs instruction, and standards-based learning results from thinking, not memorizing.
*Donna Knoell*, Shawnee Mission, Kansas
Twitter: @dknoell

**33** Using Coding and Social and Emotional Learning to Teach Mathematics in the Elementary Classroom
*3–5 Workshop*
Indiana Convention Center, Room 243–244
STEAM is for all students! This session examines how educators can use coding and strategies that support social-emotional learning to teach measurement and geometry concepts in the elementary classroom. Participants will learn basic coding techniques that will enhance students’ exploration of mathematics while fostering an inclusive atmosphere.
*Lindsay Gold*, University of Dayton, Ohio
Twitter: @lindsayangold
*John Ashurst*, Harlan Independent School District (Retired), Baxter, Kentucky
*Michael Houston*, Ellwood City, Pennsylvania

**34** Supporting Students Who Struggle: Inspiring All Students to Achieve
*6–8 Workshop*
Indiana Convention Center, Room 206–207
All students struggle. Productive struggle is encouraged and expected, yet some students struggle unproductively more than others. How can you support the students who may need intervention without removing the productive struggle? In this session, you will experience activities and teaching strategies to support all of your students.
*Mark Ray*, CPM, Elk Grove, California
Twitter: @meray00

**35** Teaching Math at a Distance: Reimagining Face-to-Face and Remote Instruction
*6–8 Workshop*
Indiana Convention Center, Room 241–242
Harness the affordances of face-to-face instruction with remote learning in any setting. This workshop will engage you in a math routine and rich task with purposeful discussion in a setting with some participants face-to-face and others joining remotely. Learn how to harness the affordances of both models to bring out rich mathematics.
*Theresa Wills*, George Mason University, Fairfax, Virginia
Twitter: @theresawills

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**Collaborating and Engaging with Tools and Technology**
**Access and Equity Both Revealed and Revisited**
**Joy of Teaching, Learning, and Doing Mathematics**
**Teaching and Learning in the Current Era**
**Broadening the Purpose of Mathematics**
**Leveraging Assessments to Promote Student Learning and Improve Instructional Programs**
Thursday Morning Workshops

9:45 a.m.–11:00 a.m.

36  Algebra Tiles + Area Model = Conceptual Understanding

8–10 Workshop
Indiana Convention Center, Room 204
Manipulatives can be successful in a secondary math classroom! See how to build on students’ understanding of an area model for multiplication using algebra tiles to multiply and factor polynomials, complete the square, and divide polynomials. This tactile engaging experience will increase conceptual understanding leading to procedural fluency.

Rhonda Pierre, CPM Educational Program, Indianapolis, Indiana

37  NASA’s FlyBy Math: Solving the World’s Largest Distance-Rate-Time Problems

8–10 Workshop
Indiana Convention Center, Room 208–209
Engage with NASA Aeronautics to solve the world’s largest DRT problem. Learn about the FlyBy Math™ simulator to conduct experiments, analyze, and solve traditional DRT problems. Learn about NASA’s free Sector 33 App that extends this activity to a mobile device. Walk away with additional resources including activity sheets, assessments, and an educational guide.

Suzanne Nichols, Ohio University, Lucasville
Barbara Buckner, NASA Goddard Space Flight Center, Laurel, Maryland

38  Fighting A Pandemic: Hands-On Models to Teach the Mathematics of Pooled Testing

Coaches/Leaders/Teacher Educators Workshop
Indiana Convention Center, Room 234–235
Join us in a hands-on workshop mirroring the student experience in a sequence of lessons to engage in a real-world problem. We will explore the benefits of pooling COVID-19 test samples to save lives, time, and money. We’ll simulate testing using hands-on lab kits and create math models using functions, statistics, and algebraic and geometric methods.

Lauren Siegel, MathHappens Foundation, Austin, Texas
Twitter: @mathhappensorg
Maria Hernandez (Retired), NC School of Science and Mathematics, Durham, North Carolina
Usha Kotelawala, Developing a Mathematical Toolkit, New York, New York

CPM Educational Program
Empowering mathematics students and teachers for 30 years through exemplary curriculum, professional development, and leadership

+ Curriculum written by a team of experienced teachers
+ Problem-based lessons for active student engagement
+ Free, comprehensive professional learning progression to support teacher expertise, growth, and leadership
+ Educational nonprofit 501(c)(3)

We are pleased to support the NCTM Regional Conference in Indianapolis. Stop by Booth 209 to meet with a CPM mentor teacher, see our materials, and request a preview.

Visit CPM.org/cpminfo or scan the QR code to get more information and view our conference sessions.

MORE MATH FOR MORE PEOPLE

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11:00 a.m.–12:00 p.m.

39  President’s Address: Bringing Joy to Teaching and Learning Mathematics
    Session
    Indiana Convention Center, Sagamore Ballroom 5
    What brings you joy in teaching and learning mathematics? What new mathematical connections have we made? Where have we encountered mathematics to see and understand our world? How have we engaged others in doing mathematics? Are there things keeping the joy from our world of mathematics? Let’s look reflectively and deeply at what we love about doing mathematics, engaging with mathematics, sharing mathematics with others, and what might be inhibiting that joy. We will explore problem solving, look at mathematics in our world, examine ways to empower our students and ourselves in learning mathematics, and identify structures or practices that may be inhibiting our joy in mathematics. Come share and rekindle that joy in mathematics!

Trena Wilkerson, President, National Council of Teachers of Mathematics, Reston, Virginia; Baylor University, Waco, Texas
Twitter: @TrenaWilkerson

40  Building Fluency with Basic Facts (Addition and Subtraction)
    PreK–2 Session
    Indiana Convention Center, Room 240
    Do your students struggle to develop fluency with basic facts? Come to this session and leave with K–2 number sense routines, activities, games, and practical ideas on how to make their use most effective. Learn how to provide all students with experiences necessary to succeed. Participants will have access to all information after the session.

Carol Kuchta, Retired, Austintown Local Schools, Newton Falls, Ohio

42  Try It before You Buy It: Developing Math Vocabulary through Exploration
    6–8 Session
    Indiana Convention Center, Room 205
    How do you define peloozoid? Explore vocabulary acquisition by putting yourself in the role of a learner again. Experiment using common tools with a team to learn how to help students understand the term proportional relationship. Using what you learned, you will be empowered to nurture students’ understanding of new terminology more effectively.

Connie Laughlin, Eureka Math, Muskego, Wisconsin
Valerie Weage, Bloomfield Hills, Michigan

43  S3D: Fostering and Improving Small-Group, Student-to-Student Discourse
    8–10 Session
    Indiana Convention Center, Room 232
    Placing students in small groups does not automatically imply that the students will be able to productively interact with one another about the mathematics. In this presentation, you will learn about strategies and tools to examine and improve your practice with respect to fostering and improving small-group, student-to-student discourse.

Sarah Quebec Fuentes, Texas Christian University, Fort Worth
Twitter: @squeuebecfuentes

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44 Enhancing Geometrical Reasoning and Proof through GeoGebra Dynamic Tools

10–12 Session
Indiana Convention Center, Sagamore Ballroom 3
In this presentation, participants are invited to use GeoGebra dynamic construction and transformation tools to explore a geometric task. Then, participants will explain their strategies and justify their conclusions. Last, a discussion will be conducted about the evolving empirical and deductive justifications.

Lili Zhou, Purdue University, West Lafayette, Indiana

45 Math Therapy: A Crash Course in Becoming a Math Therapist

Coaches/Leaders/Teacher Educators Session
Indiana Convention Center, Room 231
Did you know that pretty much anyone who thinks they’re “not a math person” has math trauma they simply haven’t worked through yet? Look, we’ve all had math teachers before—but how many of you have had a math therapist?! If you’re ready to dig deep, this crash course in math therapy is for you! This workshop will teach you the art of math therapy.

Vanessa Vakharia, The Math Guru (founder/CEO), Toronto, Ontario
Twitter: @themathguru

46 Who’s Asking the Questions in Math Class? Using Curiosity to Engage Students in Deeper Thinking

General Interest Session
Indiana Convention Center, Room 239
Even though we want students to be curious in math and value how it applies in our world, most students believe math class is a place where they’re given answers to questions they’ve never asked. Learn strategies that humanize math by inspiring students to ask their own questions, self-assess their curiosity, and engage in meaningful discourse.

Tim Hudson, DreamBox Learning, Bellevue, Washington
Twitter: @DocHudsonMath

47 Take It to the Limit: Strategies for Teaching Limits

Higher Education Session
Indiana Convention Center, Room 245
Reduce students’ struggle when acquiring the concept of limits. Start with a challenging task to connect students learning about functions and rational functions to create the basis for a deep understanding of limits and build fluency for their use.

Frederick Dillon, Strongsville, Ohio
Twitter: @fdizzle1955

47.1 Connecting Coding to Algebra

10–12 Exhibitor Workshop
Indiana Convention Center, Room 130
Coding is a skill that is in high demand. But how does computational thinking connect to my math class? See how to promote critical thinking and boost engagement by using programming in your algebra classes. No prior programming experience is required.

Texas Instruments, Dallas, Texas
Thursday Morning Bursts

48  Number Line to 10,000,000 and Other Math Manipulatives
3–5 Burst
Indiana Convention Center, Room 204
Join us for a hands-on demonstration by Jim Franklin, teacher of special education, who invented a number line to help students round numbers up to 10,000,000. View a variety of math manipulatives and learn innovative strategies for all students that address the standards of fractions, decimals, money, elapsed time, weight, and capacity.
Jim Franklin, Slide-A-Round Math Manipulatives, Rome, Georgia

49  Is a Tuna Melt Actually a Pizza? Fostering Debates and Justifications in the Math Classroom
6–8 Burst
Indiana Convention Center, Room 241–242
Is a tuna melt actually a pizza? Is a loaf of bread a sandwich? Is a book just a paper taco? This session will introduce participants to the “sandwich chat,” a model for debate in the math classroom that teachers can use throughout the year while exploring mathematical concepts. Come hungry for learning, leave hungry for sandwiches!
Justin Aion, Environmental Charter School, Pittsburgh, Pennsylvania
Twitter: @JustinAion
Shelby Strong, Self/Stronger Math Consulting, Gretna, Louisiana

50  Using Capture-Recapture to Develop Proportional Reasoning with CODAP, a Free Simulation Software
6–8 Burst
Indiana Convention Center, Room 236
Have you ever wondered how scientists estimate the number of a particular animal? In this interactive session, we will explore a technique scientists use called Capture-Recapture that relies on proportional reasoning using a free simulation software called CODAP. Connections to statistics will be made.
Mark Creager, University of Southern Indiana, Evansville

51  The Financial Life Cycle: Centering a Math Curriculum on Financial Applications
10–12 Burst
Indiana Convention Center, Room 206–207
Do you want to incorporate meaningful applications of math into your curriculum? Finance is an application all students know is valuable. This session shows how you can create a coherent curriculum for a high school math course that teaches the central precepts of personal finance. It is based on the Nobel Prize–winning life cycle hypothesis.
Jack Marley-Payne, Financial Life Cycle Education Corp (FiCycle), New York, New York
Twitter: @jackmarleypayne
Andrew Davidson, Financial Life Cycle Education Corp (FiCycle), New York, New York

52  Create Escape Rooms on Google Forms
General Interest Burst
Indiana Convention Center, Room 237–238
A step-by-step process of how to create an escape room using Google Forms will be presented. The presentation will start with a finished example. Then, the presenter will start from scratch to show how participants can use content they already have to create their own digital escape rooms.
Brian Stevens, Plum Borough School District, Pennsylvania

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53 LT-Squared—Learning and Teaching with Learning Trajectories Tool: Support for Professional Learning
PreK–2 Session
Indiana Convention Center, Sagamore Ballroom 3
Differentiation is powerfully realized through formative assessment. Learning and Teaching with Learning Trajectories is a research-based tool for delving deeply into understanding children’s thinking, with videos embodying each level of learning trajectories (all topics) and instructional activities fine-tuned for each, including videos and pdfs.
Douglas Clements, University of Denver, Colorado
Twitter: DHClements
Julie Sarama, Denver, Colorado

54 Doing the Math: Tasks to Engage and Challenge. You Can Do This!
3–5 Session
Indiana Convention Center, Sagamore Ballroom 5
Participants will discuss the importance of math tasks that truly engage students in “doing math” as well as analyzing the critical elements of such tasks. We will explore the challenges and offer solutions related to locating, developing, adapting, planning for, and implementing these tasks. But we know that you can do this!
Francis (Skip) Fennell, Past President, National Council of Teachers of Mathematics, Reston, Virginia; McDaniel College, Westminster, Maryland
Twitter: @SkipFennell
Beth Kobett, Stevenson University, Eldersburg, Maryland
Karen Karp, Johns Hopkins University, Baltimore, Maryland

55 Teaching Problem Solving to All Students
3–5 Session
Indiana Convention Center, Room 245
Teaching students to reason and problem solve is the cornerstone of quality math instruction. This session will highlight several engaging strategies such as Three Reads, Numberless Word Problems, and more that will provide multiple entry points for all students to engage in the math and ignite a passion for problem solving in your classroom!
Angela Campana, Accelerate Learning, Inc. STEMscopes Math, Taylor, Texas
Jill Lucero, Justin, Texas

56 Designing Inclusive Mathematics Learning Environments: Discourse Is Key
6–8 Session
Indiana Convention Center, Sagamore Ballroom 4
This session will explore features of the mathematics instruction that reinforces inclusivity in the classroom. Specifically, participants will consider how facilitating meaningful mathematics discussions can facilitate all students’ access and opportunities to learn.
Gladis Kersaint, University of Connecticut, Storrs
Twitter: @Gkersaint

57 Pedagogical Responsibility, or Why Mathematics Teachers’ “Whys” Matter for Inclusive Classrooms
8–10 Session
Indiana Convention Center, Room 232
Teachers’ purposes for going into teaching shape instruction in multiple ways. We show how pedagogical responsibility—commitments teachers feel is core to their work—influences instructional decisions, commitment, and inclusiveness. We suggest how professional development can better engage teachers’ “whys” to improve teacher learning toward equity and inclusion.
Ilana Horn, Vanderbilt University, Nashville, Tennessee
Twitter: @ilana_horn
Grace Chen, Vanderbilt University, Nashville, Tennessee

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58  STEAMing Up Algebra: Connecting Concepts and Engaging Students with Activities That Use Technology
8–10 Session
Indiana Convention Center, Room 240
Discover tech-based activities for algebra: Create designs with ordered pairs (CNC Machine), replicate flags with equations/inequalities (Desmos/GeoGebra), solve a system of equations to reinterpret a crash (CBR), simulate a parabolic action and model a quadratic regression (Phet.Colorado.Edu), and capture video to collect/analyze data (Physlets.org/Tracker).
Kelly Remijan, (1) Illinois Mathematics & Science Academy and (2) Independent Education Specialist, Belleville Twitter: @teachers4steam

59  The Mathematics of Lotteries: A Sociopolitical View
10–12 Session
Indiana Convention Center, Room 239
The lottery is one possible context for teaching about probability. However, we can examine lotteries more deeply with a social lens, uncover richer mathematics, and determine social justice impacts. We will use instructional routines to examine different perspectives and explore some social implications of lotteries.
Daniel Ilaria, West Chester University, West Chester, Pennsylvania Twitter: @drilaria

60  In-Service Mathematics Teachers’ Understandings and Misconceptions of Tangent Lines
Research Session
Indiana Convention Center, Room 231
This presentation will share insights of in-service teachers’ understandings and misconceptions of tangent lines. Improper definitions, visual examples, and a lack of emphasis on the formal definition of tangent lines will be addressed. A misconception-oriented protocol will also be shared.
Mark Hogue, Slippery Rock University, Pennsylvania
Richard Busi, James Madison University, Harrisonburg, Virginia

60.1  Rich Secondary Mathematics Curricula Brought to You by CPM, an Educational Nonprofit!
8–10 Exhibitor Workshop
Indiana Convention Center, Room 131
Looking for ideas to incorporate NCTM’s eight teaching practices? Let CPM show you! Our nonprofit provides rich mathematics curriculum that is student centered and problem based, encouraging thinking, persevering, and sense making with complimentary PD for teachers. Experience the excitement students do, exploring CPM’s grades 6–12 curriculum.
CPM Educational Program, Elk Grove, California

60.2  Using Manipulatives to Build Conceptual Understanding—Grades 6–8+ Algebra
6–8 Exhibitor Workshop
Indiana Convention Center, Room 130
Deepen student understanding and build conceptual understanding using hands-on lessons for grades 6–8 and Algebra. Experience Hands-on Standards: Teaching Math with Manipulatives solution. These are standards-aligned lessons, involving manipulatives, that are engaging and easy to implement in whole class and small group settings.
hand2mind, Vernon Hills, Illinois
Thursday Afternoon Workshops

1:00 p.m.–2:15 p.m.

61  **Line Dance: The Fundamentals of Using Number Lines**
   *PreK–2 Workshop*
   Indiana Convention Center, Room 234–235
   Number lines are a lovely sense-making tool, from early elementary to secondary mathematics domains. Sounds simple? Often the building and understanding are a bit elusive to students and educators! Join us for hands-on learning to construct this important tool and learn about the important foundations you are laying for grades 3–6 content.
   **Elizabeth Peyser**, Educator in Kansas, Wichita

62  **How We Introduce and Teach Fractions Affects Our Students’ Futures. Let’s Do What Works Best!**
   *3–5 Workshop*
   Indiana Convention Center, Room 206–207
   Our students’ futures depend on their understanding of fractions; it’s true. Join this session to learn about various fraction representations; what research demonstrates about the long-term consequences for students’ classroom and career choices; and how to implement small, significant changes toward best practices in your mathematics classroom.
   **Dr. Maria Franshaw**, Univ. of Wisconsin-Parkside, Kenosha
   Twitter: @mkfranshawftk

63  **Persevere: It’s Not Just for Mathematics!**
   *3–5 Workshop*
   Indiana Convention Center, Room 237–238
   All students are mathematical thinkers who can engage in discussions that promote productive struggle and perseverance. Engaging students, and keeping them engaged, in the problem-solving process requires structures and processes to go beyond math. Let’s explore structures that promote the standard to make sense of problems and persevere in solving them.
   **Rob Nickerson**, ORIGO Education, Earth City, Missouri
   **Andrea Kotowski**, ORIGO Education, Placitas, New Mexico

64  **The Proof Is in the Details: Using Random Sampling to Connect Big Ideas in Statistics and Probability**
   *6–8 Workshop*
   Indiana Convention Center, Room 236
   Random sampling is an efficient technique that reveals the relationship between probability and statistics and lays a rich foundation for inferential reasoning. Join us as we explore hands-on simulation, make inferences, and dig deeply into our own statistical knowledge to draw out big ideas that reveal themselves in subtle, yet powerful, ways.
   **Bethany LaValley**, The University of Mississippi, Oxford
   **Julie James**, University of Mississippi, Oxford

65  **Are We Better Yet? Exploring the Mathematics behind Disease Models**
   *8–10 Workshop*
   Indiana Convention Center, Room 204
   We’ve spent the last year surrounded by models. How many people are sick? Recovered? Who’s been vaccinated? More than ever before, mathematics has helped us decide where to go and what to do. Come experience an engaging, technology-integrated activity that gives middle and high school students a glimpse at the mathematics behind disease spread.
   **Mary Alice Carlson**, Montana State University, Bozeman
   **Adewale Adeolu**, Montana State University, Bozeman

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**Collaborating and Engaging with Tools and Technology**

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**Teaching and Learning in the Current Era**

**Broadening the Purpose of Mathematics**

**Leveraging Assessments to Promote Student Learning and Improve Instructional Programs**
What Do You Notice? Strategies for Inquiry with Technology  
*8–10 Workshop*
Indiana Convention Center, Room 233
Noticing and wondering, which one doesn’t belong, and action-consequence-reflection are among the inquiry strategies we will discuss to build understanding with graphing calculator and computer technology platforms. Increase student engagement and give access to all students by implementing sense-making discourse for in-person and online classes.
Karen Campe, Karen Campe, New Canaan, Connecticut
Twitter: @KarenCampe
John LaMaster, Fort Wayne, Indiana

Junk Drawer Data Collection  
*10–12 Workshop*
Indiana Convention Center, Room 243–244
Learn to engage all learners (virtual, in-person, or a little bit of both) while teaching algebra and precalculus content using common household items. A variety of technology platforms will be used to provide a deeper understanding of the content. Come, roll up your sleeves, and get your hands on the math! You will surely be engaged!
Sherri Abel, Charleston County Schools, South Carolina
Twitter: @sherriabel1014
Janice Mitchener, Indiana Online, Noblesville

Math for All: Implementing Universal Design for Learning  
*Coaches/Leaders/Teacher Educators Workshop*
Indiana Convention Center, Room 208–209
Comprehension of mathematics can be improved for all students by using principles of Universal Design for Learning in a unified approach of curriculum planning and pedagogy. The presentation will show how support practices traditionally used for accommodations to specialized subpopulations can benefit the entire spectrum of learners.
Naomi Church, Growing Minds Consulting, LLC, Deerfield Beach, Florida
Twitter: @growingmindsk12

**Thursday Afternoon Workshops**
1:00 p.m.–2:15 p.m.

- Collaborating and Engaging with Tools and Technology
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71  Making Math Wonder Filled: Sparking Imagination in Elementary Mathematics through STEAM
3–5 Session
Indiana Convention Center, Room 240
Join grades 3–5 educators as we explore how STEAM has emerged as a potential vehicle through which students might engage with mathematics more imaginatively. Storytelling, heroic qualities, humanization, extremes of experience, and limits of reality—these are a few tools that allow us to provide students with imagination-focused mathematics.
Richard Cox, Winthrop University, Rock Hill, South Carolina
Twitter: @RC_STEAM

72  Opening Pathways to Mathematics Success: Tasks and Routines That Promote Powerful Learning for All
3–5 Session
Indiana Convention Center, Room 205
Participants will engage in activities designed to invite mathematical reasoning, communication, and sense making. We’ll discuss characteristics of tasks that promote connected learning and use of the Try It, Discuss It, Connect It routine as strategies that open pathways to support all students in accessing powerful mathematical understandings.
Mark Ellis, CSU Fullerton, California
Twitter: @EllisMathEd

73  Manipulatives in Middle School? Absolutely!
6–8 Session
Indiana Convention Center, Sagamore Ballroom 3
Do your middle school students need some hands-on activities to help develop their mathematical concepts? Discover the benefits of using manipulatives in your middle school class to help students better understand math as well as some ways to use a variety of manipulatives. See why manipulatives are a powerful tool for middle school students!
Kevin Dykema, President-Elect, National Council of Teachers of Mathematics, Reston, Virginia; Mattawan Middle School, Michigan
Twitter: @kdykema

74  Project-Based Learning: Empowering Students with Positive Dispositions and Deep Understandings
8–10 Session
Indiana Convention Center, Room 245
Project-based learning (PBL) helps develop positive dispositions and build a deeper understanding of essential concepts and processes in mathematics. Learn to design PBL units that engage students in experiences that broaden the purposes of learning mathematics. We share resources from classroom-tested units to incorporate into your own projects.
Enrique Galindo, Indiana University, Bloomington, Indiana
Twitter: @cybermathedian
Jean Lee, University of Indianapolis
Lori Burch, IU Bloomington – School of Education, Bloomfield, Indiana
Julie Evans, Bloomfield School District, Indiana

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| 75 | Why Do We Really Need Radians? | 10–12 Session  
Indiana Convention Center, Room 232  
Future high school teachers know we need radians but not why! In this session, we share an activity, through a GeoGebra classroom, comparing degrees and radians to help reflect on the consequences of each unit. The focus will be on unpacking the effects of the units on slope and thus calculus. Bring a device to follow along!  
Craig Cullen, Illinois State University, Normal  
Lawrence Ssebaggala, Dalton State College, Georgia  
Oscar Chavez, Illinois State University, Normal |
| 76 | Eliciting Errors: Using Just the Right Problems We Know Students Will Get Wrong | General Interest Session  
Indiana Convention Center, Sagamore Ballroom 5  
Motivating tasks are critical for student engagement. Choosing tasks that elicit common errors is key. Create cognitive dissonance and use errors as springboards for learning to achieve maximum growth while maintaining student interest. Learn how to choose just the right problems we know students will get wrong and leave them asking for more!  
Juli Dixon, University of Central Florida, Indialantic  
Twitter: @thestrokeofluck |
| 77 | Fostering Equitable Interactions and Belonging with the Five Practices | General Interest Session  
Indiana Convention Center, Room 239  
Using the Five Practices (5 Ps) can be difficult. Timing, sequencing, connecting, and fostering student voice are all challenges. Come discuss how to effectively inspire interactions among students, teacher, and the math to remove barriers, make the 5 Ps easier for you, and ensure all students have a seat at the table. Leave with actionable solutions!  
Kathleen Sheehy, Amplify, Brooklyn, New York |
| 78 | Grants, Scholarships, and Awards for NCTM Members | General Interest Session  
Indiana Convention Center, Room 231  
Looking for funding for a special project, coursework, or professional development? NCTM’s Mathematics Education Trust (MET) has more than 30 different grants, scholarships, and awards available to NCTM members. Get information on all of these different opportunities to improve the mathematics teaching and learning in your classroom, school, or district.  
Laurie Boswell, Big Ideas Math, Franconia, New Hampshire  
Twitter: @laboswell |
| 78.1 | Transformational Graphing | 10–12 Exhibitor Workshop  
Indiana Convention Center, Room 130  
This session will use technology for inquiry to discover generalizations for graphing parent functions and their transformations. We’ll highlight a new video series that explores methods for learning to graph these transformations by hand. We’ll dive into multiple strategies to illustrate a variety of transformations for 16 parent functions.  
Texas Instruments, Dallas, Texas |
| 78.2 | A New Way to Diagnose and Address Learning Needs for Every Student in the K–8 Classroom | Coaches/Leaders/Teacher Educators Exhibitor Workshop  
Indiana Convention Center, Room 131  
We are always looking to help you obtain more actionable data and a clearer picture of where your students are in terms of understanding. Savvas Learning Company has partnered with WestEd to bring you new validated and normed assessments for use with our enVision Mathematics programs as well any Core Math Program for Grades K–8.  
Savvas Learning Company (formerly Pearson K12 Learning), Chandler, Arizona |
Thursday Afternoon Workshops

**Time Out Time Tests! Assessing Addition and Subtraction Fact Fluency**
- PreK–2 Workshop
- Indiana Convention Center, Room 236
- Fact fluency is an essential component in math success. What does fluency really mean and how can we effectively assess fluency in our students? How can we use the results to meet their specific needs? Come explore a variety of tools and strategies to measure addition and subtraction fact fluency in your students and guide instruction!
- Kristin Johnson, Troy CCSD 30-C, Minooka, Illinois
- Amy Deang, Mokena, Illinois

**Teaching Fractions with Deep Understanding and Real-Life Problem Solving: Success and Joy for All!**
- 3–5 Workshop
- Indiana Convention Center, Room 208–209
- Are you looking for great ideas to help every student understand fractions? Come learn strategies to develop deep understanding of fractions, focusing on fractions as numbers, equivalent fractions, operations with fractions, and decimal equivalence. Actively engage with real-world problem solving and effective questioning techniques. Handouts will be available.
- Donna Knoell, Shawnee Mission, Kansas

**Validating Students’ Mathematical Strengths: Using an Equity Lens for Teaching**
- 3–5 Workshop
- Indiana Convention Center, Room 234–235
- Despite negative media stereotypes, all children have strengths upon which we can build. Yet, students are often labeled high/average/low or above/below grade level. This session will explore student work samples and video clips to identify children’s strengths, understand their needs, and explore avenues for growth—the students’ and our own.
- Ryan Flessner, Butler University, Indianapolis, Indiana
- Courtney Flessner, Indiana University, Bloomington

**Daily Data: Collecting, Analyzing, and Interpreting Data in Grades 5–8**
- 6–8 Workshop
- Indiana Convention Center, Room 206–207
- Join us to explore how to create and implement data activities designed to help grades 5–8 students make sense of data they collect about themselves. We will share video clips and student work highlighting common issues as they work toward statistical literacy.
- Jennifer Talbot, Illinois State University, Bloomington
- Carrie Lawton, Normal, Illinois
- Amanda Cullen, Illinois State University, Normal

**NASA Explores Humans in Space: The Mathematics behind Space Food and Nutrition**
- 6–8 Workshop
- Indiana Convention Center, Room 237–238
- Explore NASA’s Space Food using math to investigate nutritional needs for astronauts on the International Space Station. See how body type, age, and exercise changes caloric needs. Investigate how food packaging and serving size relate. Explore a menu of inquiry activities integrating math, nutrition, and science as you satisfy your math appetite.
- Barbara Buckner, NASA Goddard Space Flight Center, Greenbelt, Maryland
- Twitter: bbuckner
- Suzanne Nichols, Ohio University, Chillicothe

**Number Talks for Secondary Students: An Opportunity for Equity, Voice, and Mathematical Reasoning**
- 8–10 Workshop
- Indiana Convention Center, Room 204
- Everyone deserves an opportunity to talk about mathematical thinking. A Number Talk routine can invite discourse, celebrate mistakes, and value all thinking. Explore with us the power of this routine as a discourse tool and equity bridge. We will watch, engage in, and do Number Talks together. You will leave ready to begin your Number Talk journey.
- Jacqueline Palmquist, Indian Prairie School District 204 Metea Valley HS, Naperville, Illinois
- Twitter: @thumbsupmath
- Patricia Baltzley, Gardiner, Montana
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| 85         | The Astounding Mathematics of Bicycle Tracks                          | 8–10 Workshop                                                        | Indiana Convention Center, Room 243–244 | There is much we can say and do with bicycle tracks, all leading to some astounding geometry surprises for students, teachers, mathematicians, and math enthusiasts alike. So, let's actually ride a bicycle down the middle of the room and analyze its path. Why not? Hold on to your wheels for this one!  
**James Tanton**, MAA, Paradise Valley, Arizona  
Twitter: @jamestanton                                                                 |
| 86         | Alternative Strategies, Deep Thinking in Secondary Content? Yes!      | 10–12 Workshop                                                       | Indiana Convention Center, Room 233  | Heard of Number Talks? What would similar Math Talks look like for secondary content, where we wonder, show curiosity, and play with different approaches for solving equations, graphing functions, and more? We can use the instructional routine Problem Strings to develop deep thinkers who experience the wonder, joy, and beauty of math.  
**Pamela Harris**, Texas State University, Kyle  
Twitter: @pwharris                                                                 |
| 87         | Islamic Design: An Interactive Workshop to Introduce the Geometry behind Islamic Art | Coaches/Leaders/Teacher Educators Workshop                            | Indiana Convention Center, Room 241–242 | Using a compass and straightedge, we will explore the constructions that underlie Islamic design. This workshop will introduce some of the history behind the tradition and then proceed to construct patterns suitable for all ages. Good for grades 5–12, but a wonderful experience for anyone seeking to further their appreciation of geometry and art.  
**Steve Pomerantz**, Saint Joseph College, Brooklyn, New York                                                                 |
Thursday Afternoon Sessions
4:00 p.m.–5:00 p.m.

88 Automaticity for Everyone! We Can Do It!
PreK–2 Session
Indiana Convention Center, Sagamore Ballroom 3
Participants will experience the developmental progression for learning facts through understanding, not memorization. What is the teacher’s role? How do you incorporate the progression into your math workshop? Do students understand strategies and relationships within the progression? How does context enhance understanding? Result: automaticity!
Lynn Rule, Retired, Wheaton, Illinois
Twitter: mathrack20

89 Improve Math Fluency during Intervention
3–5 Session
Indiana Convention Center, Sagamore Ballroom 4
Our goal in teaching is not just to prepare students for their next math class, but to prepare them for their future careers. Learn how number strings and math talks construct additive and multiplicative strategies to develop mathematical thinkers and how they can be used as an intervention tool.
Brittany Goerig, hand2mind, Midlothian, Texas
Twitter: @bgoerig

90 It’s Elementary: Using PBL to Build Students’ Mathematical Identity in the Classroom and Community
3–5 Session
Indiana Convention Center, Room 245
Learn how project-based learning (PBL) can help create inclusive classrooms where students build their mathematical identity and serve the community. Learn to design PBL units that build student agency and promote access for each and every learner of mathematics. We share resources from classroom-tested units to incorporate into your own projects.
Jean Lee, University of Indianapolis
Twitter: JeanLeeGalindo
Enrique Galindo, Indiana University, Bloomington
Brittany Tinkler, Perry Township Schools, Indianapolis, Indiana
Dr. Diane Clancy, Columbus, Indiana
Jeffrey Spencer, Perry Township Schools, Indianapolis, Indiana

92 Activating Student Agency with Equitable Teaching Practices
8–10 Session
Indiana Convention Center, Room 232
What intentional actions can teachers take to strengthen students’ mathematical identities and improve learning, especially for those who have not had equitable access or opportunity to learn mathematics? This session will explore an asset-based approach to teaching along with strategies to support deeper understanding of mathematical concepts.
Pam Lindemer, CPM Educational Program, Rockford, Michigan
Twitter: @Pam_Lindemer
Danielle Boggs, CPM Educational Program, Champaign, Illinois

Collaborating and Engaging with Tools and Technology
Access and Equity Both Revealed and Revisited
Joy of Teaching, Learning, and Doing Mathematics
Teaching and Learning in the Current Era
Broadening the Purpose of Mathematics
Leveraging Assessments to Promote Student Learning and Improve Instructional Programs
Thursday Afternoon Sessions
4:00 p.m.–5:00 p.m.

93  Connecting What We Teach to the World around Us
    10–12 Session
    Indiana Convention Center, Room 205
    Mathematics is fascinating but often does not resonate with students. *Catalyzing Change* argues that one purpose of teaching mathematics is to make sense of the world. Real data from real situations can engage students in mathematical investigations that provide opportunities to see how mathematics applies to the world in which they live.
    **Gail Burrill**, Past President, National Council of Teachers of Mathematics; Michigan State University, East Lansing

94  Math Sheltered Instruction for ELs and All Learners
    Coaches/Leaders/Teacher Educators Session
    Indiana Convention Center, Room 231
    Are you ready to provide sheltered instructional strategies to engage your ELs and all students in your math classroom? This language-rich interactive workshop will be focused on mathematical processes needed to acquire and demonstrate mathematical understanding that will support making content comprehensible and developing academic language.
    **Adrian Mendoza**, Seidltz Education, Irving, Texas
    Twitter: @adrianmendozaed

95  A Real Conversation: The Politico-Economic Necessity of Mathematical Illiteracy
    General Interest Session
    Indiana Convention Center, Sagamore Ballroom 5
    I argue that the issue with student failure in mathematics is far more systemic than individualized. It is a politico-economic necessity for students (especially of historically marginalized groups) to be mathematically illiterate and unsuccessful in order to maintain the societal status quo and current power discrepancies.
    **Akil Parker**, Cheyney University, Pennsylvania

96  Discourse for Assessment — Moving the Conversation Forward
    General Interest Session
    Indiana Convention Center, Room 239
    How do we create an equitable learning environment that encourages and nurtures student-to-student discourse, and how can we use discussion to advance student thinking? We will discuss why discourse for assessment is an equity issue, how to create a discourse-rich class environment, and how to use the discourse to support all learners.
    **Carrie Thornton**, Great Minds, Auburn, Washington
Thursday Afternoon Bursts

97  Mathematicians Look Like Me: Humanizing the Story of Who Does Mathematics
6–8 Burst
Indiana Convention Center, Room 234–235
When we search “famous mathematician,” we are greeted by a long row of White male faces. It is important that all of our students see themselves reflected in the work of mathematics. In this workshop we will examine our own preconceptions of who does the work of math and discuss easy to implement strategies to change that.

Ella Hereth, Indianapolis Public Schools
Twitter: @MsHereth
Evan Taylor, Indianapolis Public Schools

98  Creating an Equitable Classroom: Practical Strategies for Struggling Learners
10–12 Burst
Indiana Convention Center, Room 233
Struggling learners are all too common in math classes. What can we do to make our math classes fair and accessible even for students who lack prior knowledge, who are deeply discouraged, and distrust schools and teachers? David Albertsen is an experienced teacher in math and special education who currently teaches at an alternative high school.

David Albertsen, Granite School District, Magna, Utah

99  Inspiring Students to See the Fun and Beauty in Mathematics
General Interest Burst
Indiana Convention Center, Room 204
As teachers, we need to help students see that math can be fun and beautiful by giving them opportunities to explore connections to art, nature, sports, and real life. Participants will explore strategies to get students involved in discovering the fun and beauty of math through photos, drawings, and fun activities.

Mark Colgan, Taylor University, Upland, Indiana

100  When Everyday Language and Mathematics Meet
General Interest Burst
Indiana Convention Center, Room 241–242
It is with and through language that we learn mathematics. In this session we will explore some ways in which everyday language can create unintentional barriers and opportunities in the mathematics classroom. In exploring these instances, we will consider how to promote access and understanding of important mathematical ideas.

Zandra de Araujo, Board of Directors, National Council of Teachers of Mathematics, Reston, Virginia; University of Missouri, Columbia
Twitter: @zdearaujo

101  Lessons Learned from Prepandemic Online Program for the Postpandemic World
Higher Education Burst
Indiana Convention Center, Room 243–244
Results of the analysis of data collected from an online math refresher program designed to help incoming students pass their first math course will be shared. Students’ views on online programs prepandemic and their implications for online programs in a postpandemic setting will be explored.

Jodi Frost, Indiana State University, Terre Haute, California
Jessica Markle, Indiana State University, Linton
Patti Dreher, Indiana State University, Terre Haute
102 Regional Conference Overview and Orientation

Workshop
Indiana Convention Center, Room 241–242
Whether you’re new to NCTM or a seasoned veteran, there is something for you at the conference! Hosted by members of the Board of Directors, this session will show you how to maximize your overall conference experience. Learn all the new, innovative aspects this year’s meeting is showcasing or discover something you’ve missed in the past. Find out how to navigate presentations, learn how to use the conference app, and network with other attendees.

Dewey Gottlieb, Board of Directors, National Council of Teachers of Mathematics, Reston, Virginia; Hawaii Department of Education, Honolulu
Twitter: @dewgott
Jennifer Suh, Board of Directors, National Council of Teachers of Mathematics, Reston, Virginia; George Mason University, Fairfax, Virginia
Twitter: @completecmath

103 Mathematizing Children’s Literature: Sparking Connections, Joy, and Wonder through Read-Alouds

PreK–2 Session
Indiana Convention Center, Room 245
Within the pages of children’s literature lie vibrant opportunities for young mathematicians to notice, wonder about, and experience joy for mathematics. Join us to think about how to approach stories with a mathematical lens and nurture students’ positive identities and strong agency as mathematical sense makers through read-alouds and discussion.

Allison Hintz, University of Washington, Bothell
Twitter: @allisonhintz124
Antony Smith, University of Washington, Bothell

104 Using Number Sense Routines in an Intervention Setting

PreK–2 Session
Indiana Convention Center, Room 232
This session will focus on integrating number sense routines into individual and small-group intervention settings. Number sense routines engage students in mathematical thinking and discourse and provide motivation for students who struggle with math concepts. Routines can be designed to focus on the specific concepts being taught in a small group.

Beth Larner, The Orchard School, Indianapolis, Indiana

105 Using the Five Practices to Close Learning Gaps

6–8 Session
Indiana Convention Center, Room 205
Using the Five Practices in your classroom not only engages in mathematical conversations but can also be a powerful tool in closing the learning gaps created during the school closures of 2020. Learn to use advancing and assessing questions more effectively to push learning forward in areas where students need it most.

Gita Dev, Open Up Resources, Erie, Pennsylvania
Morgan Stipe, Open Up Resources, Carroll, Iowa

106 Promoting Student Learning through Self-Assessment and Standards-Based Grading

8–10 Session
Indiana Convention Center, Room 240
Do your students’ grades align with their learning? Do you struggle to assess learning in equitable ways? Do you empower your students through assessment? Come explore a standards-based mindset for teaching and learning and discuss aspects of standards-based grading in practice and using student self-assessment to foster learning in the classroom.

Janet Andreasen, University of Central Florida, Orlando
Twitter: JanetAndreasen
Ashley Schmidt, University of Central Florida, Orlando
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<td>107</td>
<td>Effective Assessment Practices in the AP Calculus Classroom</td>
<td>Indiana Convention Center, Sagamore Ballroom 3</td>
<td>In this session, I will share my experiences with assessing students in the AP Calculus program at Avon High School during the past 25 years. Special focus will be placed upon the strong correlation that exists between students’ actual AP Exam scores and their performances on the classroom assessments used at AHS—all of which will be shared. Anthony Record, Avon Community School Corporation, Indiana Twitter: @APCalcTchr</td>
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<td>108</td>
<td>Playing Nice with the Mean Value Theorem</td>
<td>Indiana Convention Center, Room 239</td>
<td>Classroom discussion about average rate of change generated from explorations with technology anchor their understanding of the Mean Value Theorem. Analysis of functions connected to the concept of motion but expanded to others concepts will serve as a foundation for discovering the consequence of the theorem and the importance of its conditions. Dennis Wilson, Landmark Christian School, Fairburn, Georgia Twitter: @eyesofnewton</td>
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<td>111</td>
<td>Supporting Professional Learning Communities to Enhance Mathematics Instruction by Leveraging Data</td>
<td>Indiana Convention Center, Sagamore Ballroom 4</td>
<td>Discover the power and potential of PLCs. This session will include concrete practices to facilitate and structure a high quality PLC for teachers by: – Ensuring content aligns to teachers’ authentic practice – Centering on student work and data – Supporting strong teacher engagement These ideas emerged from our research on a virtual PLC. Tina Cardone, Lesley University, Cambridge, Massachusetts Twitter: @TinaCardone Cristina Lindquist Heffernan, The ASSISTments Foundation, Shrewsbury, Massachusetts</td>
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<td>111.1</td>
<td>Building A Math Fluency Routine for Grades 6–8</td>
<td>Indiana Convention Center, Room 130</td>
<td>How can you build a math fluency routine that develops number sense and efficiency, flexibility, and accuracy with operations in just 10 minutes a day? We’ll experience how number strings and math talks can increase your students’ confidence in mathematics with hand2mind’s Daily Math Fluency program. hand2mind, Vernon Hills, Illinois</td>
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| 112 | Teaching Algebraic Thinking and Problem Solving without the X’s | PreK–2 Workshop  
Strategies to develop algebraic thinking, including use of the equals sign, other representations, patterns, and solving for unknowns will be the focus for this hands-on workshop. Attendees will be actively engaged with manipulatives, effective questioning strategies, and the exploration of real-life problems that promote algebraic thinking.  
Donna Knoell, Shawnee Mission, Kansas  
Twitter: @dknoell | Indiana Convention Center, Room 241–242 | Donna Knoell |
| 113 | Developing Meaning with Fraction Operations | 3–5 Workshop  
It’s difficult to find effective concrete models for fraction operations. This session will demonstrate the use of common materials already in your classroom to teach fraction operations. These materials are guaranteed to build understanding while developing common computational procedures.  
Bob Drake, Univ of Cincinnati (retired), Ohio | Indiana Convention Center, Room 208–209 | Bob Drake |
| 114 | Tasks That Trigger Thoughtful Talk | 3–5 Workshop  
Many of the attributes of polygons (side length, angle measure, symmetry, perimeter, and area) can be explored using paper folding, perimeter pieces, square tiles, and grid paper. We’ll work through a series of tasks that help students make sense of these attributes. Tasks are designed to have entry levels for all students.  
Laurie Boswell, Big Ideas Math, Franconia, New Hampshire  
Twitter: @laboswell | Indiana Convention Center, Room 233 | Laurie Boswell |
| 115 | Mathematical Modeling—Imperative in 2022!  
Preparing Students to Mathematize a Complex World | 6–8 Workshop  
Teaching our students to mathematize contexts and analyze models in front of them has never been more imperative. We’ll explore an instructional routine that leverages a relevant context, provides access and support for all learners, and, if implemented regularly, develops students’ capacities as modelers and mathematically creative, engaged citizens.  
Amy Lucenta, Fostering Math Practices, Natick, Massachusetts  
Grace Kelemanik, Fostering Math Practices, Natick, Massachusetts | Indiana Convention Center, Room 243–244 | Amy Lucenta, Grace Kelemanik |
| 116 | Nurturing Mathematical Identity and Agency: Using Desmos to Empower and Engage Students | 6–8 Workshop  
Learn how integrating effective instructional habits with the use of Desmos can promote a positive mathematical identity and nurture mathematical agency. Teachers will participate in learning activities that they can use with their students, and reflect upon how the instructional strategies help students achieve the goals we are working toward.  
Dewey Gottlieb, Board of Directors, National Council of Teachers of Mathematics, Reston, Virginia; Hawaii Department of Education, Honolulu  
Twitter: @dewgott | Indiana Convention Center, Room 206–207 | Dewey Gottlieb |
| 117 | Practical Strategies (Equity + Social Justice) = Empowerment for All | 6–8 Workshop  
We share a framework to support mathematics teachers’ equity- and social justice-driven work in three overlapping arenas: self, students, and pedagogy. Participants will take away a personally curated list of practical strategies to enact effective and equitable mathematics instruction infused with issues of social justice for all students.  
Gina Yoder, Indiana University-Purdue University Indianapolis  
Kara Benson, Zionsville Community Schools, Indiana  
Jas’mínique Potter, MSD of Wayne Township, Indianapolis, Indiana | Indiana Convention Center, Room 204 | Gina Yoder, Kara Benson, Jas’mínique Potter |
| 118 | Climate Change: Math Activities Using Data from Al Gore’s Climate Project and the US Climate Report | 10–12 Workshop  
Obtain the most current climate change data, causes, and consequences. Model this shocking data obtained from attending the 3-Day Climate Reality Training (see Gore’s latest PowerPoint slides). Students become aware of this important issue by modeling applied mathematics. Obtain all materials: data, student sheets, teacher notes, detailed instructions.  
Tom Reardon, Fitch High School/Youngstown State University, Poland, Ohio  
Twitter: @tomreardon3 | Indiana Convention Center, Room 237–238 | Tom Reardon |
Friday Morning Workshops

119  We Teach What We Assess: Writing Common Assessments to Shift Instruction across Classrooms
Coaches/Leaders/Teacher Educators Workshop
Indiana Convention Center, Room 236
How can the collaborative development of high-quality exams improve math instruction? When common assessments are designed to push past procedural fluency and assess students’ conceptual and contextual understanding, teachers shift their curricular and instructional practices. We explore how this fits into improvement efforts and model the process.
Claudine Margolis, University of Michigan, Ann Arbor
Twitter: @cmars585
Joseph Agron, Summit View Learning, Shelburne Falls, Massachusetts
Emily Williams, Summit View Learning, Spokane, Washington

120  “We Believe”: One School District’s Efforts to Improve Mathematics Teaching and Learning
Coaches/Leaders/Teacher Educators Workshop
Indiana Convention Center, Room 234–235
This session examines one school district’s “We Believe” statements as constructed by its Math Leadership Team. The document guided decisions related to the teaching and learning of mathematics in the district. Participants will co-construct “We Believe” statements and leave with knowledge to replicate the process in their own schools or districts.
Courtney Flessner, Indiana University, Bloomington
Twitter: @cfless
Ryan Flessner, Butler University, Indianapolis, Indiana
Jennifer Townsend, Noblesville Schools, Indiana
Lauren Smith, Noblesville Schools, Indiana

Friday Morning Sessions

121  Playing in the ZPD: How Games-Based Formative Assessment Can Drive Mastery of Early Numeracy
PreK–2 Session
Indiana Convention Center, Room 240
Meeting the individual needs of many students simultaneously can be a challenge. This session shares how the theories of Vygotsky (ZPD) and Bloom (Mastery Learning) are combined with current research on evidence-centered design and game-based assessment to create adaptive instructional systems that help young children master early numeracy.
Anastasia Betts, Age of Learning, Inc., Fontana, California
KP Thai, Age of Learning, Inc., Glendale, California

122  Getting to the Heart of Math Matters: Challenging Learner Mindsets and Shifting Pedagogies
3–5 Session
Indiana Convention Center, Sagamore Ballroom 3
Developing teachers’ critical awareness is necessary for addressing deficit ideology and heightening teachers’ awareness that words matter. Although we must help teachers understand how the words we use shape identities, we must also help them view students through an asset-based lens. Doing so can change beliefs, which shape the words we use.
Tracy Donohue, Michigan State University, Milford
Twitter: @tdonohue08

123  Math Solver Apps: A Teacher’s Friend or Foe?
6–8 Session
Indiana Convention Center, Room 232
The digital age has brought artificial intelligence powered math solvers to our students. Is this a way of cheating on homework and tests or an important support tool for remote schooling? In this session we will explore how these math apps can help teachers examine how they assess and attend to teaching the full breadth of the standards.
Bill Nolan, NWEA, Portland, Oregon
James Pratt, NWEA, Portland, Oregon

124  Reflecting on Mathematical Discourse
8–10 Session
Indiana Convention Center, Room 205
Planning for class discussion can make instruction more effective. Reflecting on our practice can help us better understand the impact of our planning and provide insight on how we can further support student sense making and connections. Come learn how I use the Five Practices to facilitate effective and engaging class discussion.
Leah Simon, Dixie High School, New Lebanon, Ohio
Twitter: @SimonSaysMath

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**Friday Morning Sessions**

9:30 a.m.–10:30 a.m.

### 125 Informed Investing: Using Math to Evaluate GameStop

**10–12 Session**  
Indiana Convention Center, Sagamore Ballroom 4  
The remarkable rise and fall of GameStop share prices introduced many students to the stock market. Learn how using math, students can discover how to estimate stock value based on objective criteria and decide for themselves whether “meme stocks” are a safe or risky investment.

**Andrew Davidson,** Financial Life Cycle Education Corp (FiCycle), New York, New York  
Twitter: @ficycleedu


**Jack Marley-Payne,** Financial Life Cycle Education Corp (FiCycle), New York, New York

### 126 Positioning ELs for Success

**Coaches/Leaders/Teacher Educators Session**  
Indiana Convention Center, Room 239  
How is your Spanish? The myth that math is a universal language persists and yet we are struggling to meet the needs of ELs. Three-quarters of ELs are Spanish-speaking—this motivating session focuses on them. The author of a popular book for teachers will teach you how you may position ELs to be successful.

**James Ewing,** Stephen F. Austin State University, Nacogdoches, Texas  
Twitter: @EwingLearning

### 127 Broadening the Purpose and Value of Mathematics through Curiosity and Storytelling

**General Interest Session**  
Indiana Convention Center, Sagamore Ballroom 5  
Why did our romance with mathematics end? How can we resurrect our love for mathematics that is grounded in our unique cultural experiences and identity with this subject? In this workshop, we will address that question and the needed solutions by looking at the 5,000-year history of mathematics, and nurturing a lifetime thirst for its narratives.

**Sunil Singh,** Amplify, Brooklyn, New York  
Twitter: @Mathgarden

### 129 I Will Be a Math Teacher: Reflections from Elementary Generalists in a Math Content Course

**Higher Education Session**  
Indiana Convention Center, Room 231  
In this session we examine preservice generalist elementary teachers’ reflections during a mathematics content course including the question, “What type of math teacher I want to be” with pre- and post-reflections. We also discuss our experiences as a facilitator of teachers developing their identities as math teachers.

**Christine Taylor,** Indiana State University, Terre Haute

### 129.1 Curiosity and Exploration: Passing the Legacy to Our Students

**10–12 Exhibitor Workshop**  
Indiana Convention Center, Room 130  
How do we turn the phrase “Exploring our world through math” on its head? By exploring math through the world, we give students opportunities to engage with the questions they have about the world. Join us for this exciting session where we’ll explore the joy and beauty of math and consider ways to pass a legacy of curiosity to our students.

**Texas Instruments,** Dallas, Texas

### 129.2 The “R” in CRL (Culturally Responsive Learning)

**Coaches/Leaders/Teacher Educators Exhibitor Workshop**  
Indiana Convention Center, Room 131  
A critical aspect of Culturally Responsive Learning is selecting tasks that invite students to author and share their own ideas. Let’s experience how 3-Act Math tasks promote student agency and authorship of mathematical ideas where teachers actively respond to different student cultures, backgrounds, and ideas to drive instruction.

**Savvas Learning Company (formerly Pearson K12 Learning),** Chandler, Arizona
NCTM School and District Workshops Deliver Powerful Learning

NEW! Virtual Custom Workshops Available

NCTM Professional Learning Services offers a wide range of customized, evidence-based professional learning opportunities designed for teachers and school teams.

NCTM workshops are available for in-school or remote learning to help expand teachers' understanding of mathematics concepts, develop effective instructional strategies, and positively affect student learning outcomes.

NCTM FOCAL AREAS

- Productive Struggle (PK–2, 3–5, 6–8, 9–12)
- Facilitating Discourse (PK–2, 3–5, 6–8, 9–12)
- Algebra Readiness (6–8)
- Making Mathematics Accessible (4–8)
- Building a System of Tens (K–8)
- Making Meaning for Operations (K–8)
- Measuring Space in Dimensions (K–8)
- Orchestrating Productive Discussions in Math Classrooms (6–8)
- Catalyzing Change in Middle School Mathematics (6–8)

Visit NCTM Professional Learning Solutions nctm.org/professionalservices for a free consultation, or contact Chonda Long at clong@nctm.org or (800) 235-7566.
**Friday Morning Workshops**

9:45 a.m.–11:00 a.m.

130 New and Preservice Teachers’ Workshop

*Workshop*

Indiana Convention Center, Room 236

Find answers to your questions on topics such as classroom management, parents, motivation, and keeping your sanity. Connect with other new teachers, learn from experienced professionals, and find resources to engage you and your students. You might even win a prize!

**David Barnes**, NCTM, Reston, Virginia

131 The Joy of Mathematics: Learning Connections through a Child’s Lens

*PreK–2 Workshop*

Indiana Convention Center, Room 234–235

Presenters will work with participants to dig deep into base-ten 10 place-value patterns by exploring base 5, base 7, and team-made systems mirroring how systems generate numbers. After participants generate numbers using different systems, they will solve problems using those systems with and without access to manipulatives.

**Cynthia Moore**, Dallas ISD, Farmers Branch, Texas

Twitter: @CindiLeeDISD

**Aneeka Arkansas**, Chapel Hill Preparatory in Dallas ISD, Farmers Branch, Texas

132 Jesse’s Train: Exploring Fractional Relationships through Collaborative Problem Solving

*3–5 Workshop*

Indiana Convention Center, Room 206–207

Collaborative problem solving provides all learners the opportunity to discuss ideas, share strategies, and explore concepts through multiple perspectives. Join us as we work together to solve a perplexing task that illuminates fractional relationships using Cuisenaire Rods.

**Julie James**, University of Mississippi, Oxford

Twitter: @james12278

**Alice Steimle**, Center for Math and Science Education, University of Mississippi, University

**Kayden Kelly**, Oxford, Mississippi

133 Quadrilateral Quandary

*3–5 Workshop*

Indiana Convention Center, Room 237–238

Do you have students who get in a quandary when asked whether a square is always a rectangle or a rectangle is always a square? Join us in exploring a scaffolding lesson that uses hands-on manipulatives and on-line activities to focus on properties and solve your students’ quadrilateral quandary questions.

**Adam Harbaugh**, Missouri State University, Springfield

**Gay Ragan**, Springfield, Missouri

**Kurt Killion**, Springfield, Missouri

134 Let’s Talk about It: Using Desmos to Encourage Math Conversations

*6–8 Workshop*

Indiana Convention Center, Room 233

Getting students to successfully talk about math strategies is challenging in a traditional classroom, let alone remote and hybrid learning. Participants will learn how to share student work, encourage explanations, and increase student voice using dynamic Desmos Activities. For new or beginning users to Desmos.

**Jessica Breur**, Mounds View Public Schools, Shoreview, Minnesota

Twitter: @breurbreur

**Ella Hereth**, Indianapolis, Indiana

135 Pivot and Punt: Teaching Math in a Pandemic

*6–8 Workshop*

Indiana Convention Center, Room 241–242

How does a teacher effectively teach math in a continuously changing delivery method of virtual, hybrid, face-to-face, and back again? I will share methods that worked, as well as attempts that were epic failures. Participants will engage in math learning as my students did—some face-to-face while others will experience the virtual version.

**Holly Miller**, Hamilton Southeastern Schools, Fishers, Indiana

Twitter: @hmillerRSI

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Collaborating and Engaging with Tools and Technology

Access and Equity Both Revealed and Revisited

Joy of Teaching, Learning, and Doing Mathematics

Teaching and Learning in the Current Era

Broadening the Purpose of Mathematics

Leveraging Assessments to Promote Student Learning and Improve Instructional Programs
### Exploring Mathematics Teachers’ Circles with Rational Tangles

**8–10 Workshop**  
Indiana Convention Center, Room 208–209

This session will discuss Math Teachers’ Circles, a free professional development opportunity where math teachers rekindle their love of mathematics while reflecting on pedagogy. In this session, we will engage in a Circle activity together by exploring the math of rope tangles. Come ready to look for patterns (and get some light exercise)!

**Chris Bolognese**, Columbus Academy, Gahanna, Ohio  
Twitter: @eulersnephew

### Math, TikToks, and Think Tanks

**8–10 Workshop**  
Indiana Convention Center, Room 204

We all find math exciting, but when was the last time that you made math fun for yourself, not just your students? Come, do math, talk math, and learn about math and TikTok.

**Nicole Justice**, Chesterfield County Public Schools, Virginia  
Twitter: @MathAndJustice  
**Penelope Hobbs**, Norfolk, Virginia  
**Jacqueline McCarty**, Norfolk Public Schools, Virginia  
**Connie Moore**, Norfolk Public Schools, Virginia

### What Does It Even Mean to “Express Regularity”? Interpreting, Assessing, and Scaffolding the SMP

**Coaches/Leaders/Teacher Educators Workshop**  
Indiana Convention Center, Room 243–244

How can teachers scaffold and assess the eight Standards for Mathematical Practice (SMP)? Despite the Common Core’s widespread adoption 10 years ago, we have relatively few tools to know how well students are learning the SMP. In this session we’ll examine tasks, student work, and strategies to help us equitably assess, teach, and understand the SMP.

**Geoff Krall**, University of Wyoming, Fort Collins, Colorado

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### Friday Morning Workshops

9:45 a.m.–11:00 a.m.

- Exploring Mathematics Teachers’ Circles with Rational Tangles
- Math, TikToks, and Think Tanks
- What Does It Even Mean to “Express Regularity”? Interpreting, Assessing, and Scaffolding the SMP
- Collaborating and Engaging with Tools and Technology
- Access and Equity Both Revealed and Revisited
- Joy of Teaching, Learning, and Doing Mathematics
- Teaching and Learning in the Current Era
- Broadening the Purpose of Mathematics
- Leveraging Assessments to Promote Student Learning and Improve Instructional Programs
Friday Morning Sessions

11:00 a.m.–12:00 p.m.

140 Constructing and Cultivating a Strengths-Based Mathematics Classroom
   3–5 Session
   Indiana Convention Center, Sagamore Ballroom 4
   All students hold mathematical brilliance and capacity. You can create a strengths-based classroom by incorporating particular strategies that will have you and your students recognizing and leveraging strengths in every facet of the classroom environment, including designing mathematics instruction, facilitating feedback, and strengths spotting.
   Beth Kobett, Stevenson University, Eldersburg, Maryland
   Twitter: @bkobett
   Karen Karp, Johns Hopkins, Louisville, Kentucky

141 Teaching Mathematics as a Tool for Liberation
   6–8 Session
   Indiana Convention Center, Room 239
   Students will see freedom and liberation in mathematics when they are given space to use their voices and experiences. This session will focus on the ways in which we can create and sustain student agency and confidence in order for all students to see themselves as change makers for themselves and their communities.
   Crystal Watson, Cincinnati Public Schools, Ohio
   Twitter: @CrystalMWatson

142 Want to Develop Fluency with Functions? Algebrafy Patterns!
   6–8 Session
   Indiana Convention Center, Room 205
   Participants will be provided with classroom-ready hands-on lessons that enable students to connect patterns and recursive rules to functions. Emphasis will be placed on connecting concrete, pictorial, and abstract representations to help students develop conceptual understanding, refine procedural fluency, and analyze change in various contexts.
   Thomas Beatini, Union City Board of Education, New Jersey
   Twitter: @BeatiniTom

143 AP Prep for Success: Increasing Pass Rates among Historically Excluded Learners
   10–12 Session
   Indiana Convention Center, Room 232
   This presentation will focus on our approach to increasing the performance of Black and Brown students in AP Calculus and AP Statistics. Although we teach at a traditionally marginalized school, we are committed to increasing AP pass rates. We’ll share various techniques and strategies we use, as we have seen significant increases in our AP scores.
   Alana Tholen, Kipp Texas Public Schools, Hiawatha, Iowa

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144 Log In! Exploring Logarithms through Experimentation and Play
10–12 Session
Indiana Convention Center, Room 240
Learn how to create and use a new manipulative to discover the properties of logs! Make use of physical manipulatives that display all the properties of logs and allow for discovery of these properties through play and experimentation. All attendees will get a free printable 2D version of the manipulative and materials to use with their students.
Jack Marley-Payne, Financial Life Cycle Education Corp (FiCycle), New York, New York

145 Increase Underserved Students’ Mathematical Agency by Using Equity Commentators in Lesson Study
Coach/Leaders/Teacher Educators Session
Indiana Convention Center, Room 231
Adding equity commentators in the lesson study cycle elevates the commitment to equity, as commentators offer feedback throughout the cycle and share commentary including comments and critiques built upon the evidence of what is noticed about focal students as they are working to make sense of mathematics while exercising their agency.
Susie Hakansson, Independent Mathematics Education Consultant, Venice, California
Twitter: @SusieHakansson

146 There’s an App for That: Integrating Digital Tools into Mathematics Instruction
General Interest Session
Indiana Convention Center, Sagamore Ballroom 3
Are you looking for high-quality math apps to engage your students in reasoning and sensemaking? A group of experienced K–16 mathematics teachers curated a list of websites that provide free apps to enhance math instruction. In this session, you will explore and evaluate these math apps and create tasks that integrate math apps in meaningful ways.
Jonathan Watkins, Ball State University, Muncie, Indiana

147 You’re Not Wrong: How to Change Teacher and Student Mindset with Blended Learning
General Interest Session
Indiana Convention Center, Sagamore Ballroom 5
How would students describe your class? Do they have a voice, choice, and chances to be creative? After remote teaching, teachers have a unique opportunity to gain insight into how they are teaching. Bringing in new tools, ideas, and opportunities doesn’t mean you have been doing it all wrong. Let’s talk blended learning, mindset, and math!
Susan McGrath, Fayette County Public Schools, Lexington, Kentucky
Twitter: @SMcGrath
Jason Reed, Fayette County Public Schools, Lexington, Kentucky

147.1 Playing with Quadratics in Standard Form and Other Curiosities
10–12 Exhibitor Workshop
Indiana Convention Center, Room 130
How can we engage our students in the beauty and wonder of mathematics? Often, we explore math in unusual places. But what about the puzzles that lie within mathematics itself? Come dive into interesting relationships within the world of Quadratics.
Texas Instruments, Dallas, Texas
148  Get Them Talking! Leveraging Curiosity to Engage Young Learners in Mathematical Conversation
PreK–2 Burst
Indiana Convention Center, Room 204
How can educators capitalize on the natural wonder and curiosity young learners typically bring to school? In this session we will explore methods to establish routines that continue to foster curiosity and encourage young learners to continue the conversation in mathematics rather than turning it into a search for “the right answer.”
Ryan White, Phalen Virtual Leadership Academy, Indianapolis, Indiana
Twitter: @rwhite_teacher1

149  Identifying Elementary Standards That Lend Themselves to Rich Mathematical Tasks
3–5 Burst
Indiana Convention Center, Room 241–242
Presenters will analyze grades 3–5 content standards using the Stein and Smith (1998) mathematical cognitive demand framework. Particular attention will be paid to determining how standards lend or do not lend themselves to higher cognitive demand tasks. Examples will be provided of standards and tasks that span the levels of cognitive demand.
Brooke Max, Purdue University, West Lafayette, Indiana
Andrew Hoffman, Huntington University, Indiana

150  The Joy of Cooking, Crafting, and Fractions
6–8 Burst
Indiana Convention Center, Room 237–238
Cooking, crafting, and building present great opportunities to explore fraction division and multiplication using authentic problems. Come join the fun as participants rotate through activities inspired by international recipes and crafts, children’s literature, and community gardening planning.
Cindy Ticknor, Columbus State University, Georgia
Twitter: @CindyTicknor

151  Asking Questions to Promote Students’ Access and Engagement in Mathematics
General Interest Burst
Indiana Convention Center, Room 243–244
Participants will engage in activities on how questioning elicits deeper student thinking when solving cognitively-challenging tasks. Participants will identify questions in classroom videos and extend this experience by considering how questioning can promote access and engagement as well as opportunities for more students’ voice in mathematics.
Amber Candela, University of Missouri – St. Louis, Saint Louis
Twitter: @amcan36
Melissa Boston, Board of Directors, National Council of Teachers of Mathematics, Reston, Virginia; Ellwood City, Pennsylvania
Juli Dixon, University of Central Florida, Indialantic
Friday Afternoon Sessions

152 Beyond Rote Practice, Making Practice Engaging, Dynamic, and with Number Sense in Mind.
   PreK–2 Session
   Indiana Convention Center, Room 205
   How can we engage young learners in dynamic practice to support depth of knowledge while developing their number sense through play, games, and conceptual practice? Join our session to explore practice opportunities beyond rote practice.
   Julie Winfrey, Curriculum Associates, Anniston, Alabama
   Cory Howard, Trine University, Logansport, Indiana

153 Getting to the Good Stuff: Equity through Eliminating Unproductive Struggle
   3–5 Session
   Indiana Convention Center, Room 240
   Many students struggle in math simply because they can’t access the content. Struggles with reading and writing get in the way of students’ independent practice and showing teachers what they really know. In this session we will break down barriers by identifying and removing these unproductive struggles while maintaining mathematical rigor.
   Amanda Roddey, Great Minds, Washington, District of Columbia
   LauraMarie Coleman, Great Minds, Apalachin, New York

154 Manipulatives, Real and Virtual: Effectively Teaching the Standards
   3–5 Session
   Indiana Convention Center, Room 232
   Are you looking for ways to help your students develop a strong conceptual understanding in math and to better engage them in their learning? Discover benefits of using virtual and traditional manipulatives in your class to help every student better understand math as well as some ways to use a variety of manipulatives.
   Kevin Dykema, President-Elect, National Council of Teachers of Mathematics, Reston, Virginia; Mattawan Middle School, Michigan
   Twitter: @kdykema

155 Welcoming all Students into the Middle School Classroom with Culturally Responsive Tasks
   6–8 Session
   Indiana Convention Center, Sagamore Ballroom 4
   Culturally responsive problem-solving tasks invite great conversations in the middle school mathematics classroom. When students have multiple entries points for ideas about effective and efficient ways of approaching a task, great things happen – especially when everyone is connecting with the lesson based on their own cultural experiences.
   Lloyd Jones, Curriculum Associates, Hendersonville, North Carolina

156 Fun Functions: Interesting Function Activities That Highlight the Mathematical Practices
   8–10 Session
   Indiana Convention Center, Sagamore Ballroom 3
   Participants will experience several activities concerning functions: (1) using a human graph to explore functions, domain/range, and asymptotes, (2) function machines, (3) a silent board game, and (4) transformations of parent graphs. The session ends with a Function Treasure Hunt. The CCSS Mathematical Practices will be processed throughout.
   Marcus Blakeney, Jefferson County Public School, Louisville, Kentucky
   Twitter: @TheOneDoesMath

1:00 p.m.–2:00 p.m.

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157 Using Content Circles at the Secondary Level to Engage Learners
   8–10 Session
   Indiana Convention Center, Room 245
   In this presentation, a brief overview of Restorative Practices and content circles will be presented to novice and advanced practitioners on how important they can be in a rich discussion-based math classroom. All will then participate in a math content-based circle to show how trust and connection are built upon to engage students. Data shared.
   Cori Moran, School District of South Milwaukee, Wisconsin

158 3, 2, 1 Liftoff with NASA STEM Engagement!
   General Interest Session
   Indiana Convention Center, Sagamore Ballroom 5
   In this session, you will be provided with an overview of how-to best guide STE(A)M learning in K–grade 12 using mathematics, culturally responsive teaching tips and strategies, engineering design processes, and NASA educational resources. Take advantage of NASA’s free STEM resources and encourage all students to reach for the stars!
   LaTina Taylor, NASA EPDC – Texas State University, Flossmoor, Illinois

159 When Is DOK Just OK?
   General Interest Session
   Indiana Convention Center, Room 239
   The emphasis of the three aspects of rigor in college- and career-ready standards, requires our conversations to evolve beyond the limitations of the DOK framework. The Framework for Cognitive Complexity in Mathematics empowers leaders to meet the demands of the standards with resources through a balance of rigor and a range of complexity.
   Sarka Mraz, NWEA, Portland, Oregon
   Ted Coe, NWEA, Portland, Oregon

160 Centering F.a.M.I.L.Y in Black Girls’ STEM Learning
   Research Session
   Indiana Convention Center, Room 231
   Come and learn about Girls STEM Institute’s F.a.M.I.L.Y project, which provides Black girls and their caregivers opportunities to collaboratively complete multidisciplinary holistic STEM learning experiences. Black girls, parents/caregivers and program staff will share their stories. Join us as we discuss the power of engaging families.
   Crystal Hill Morton, IUPUI, Beech Grove, Indiana
   Twitter: @drhillmorton
   Renee Barlow, IUPUI, Indianapolis, Indiana
   Chanae Palmer, IUPUI, Indianapolis, Indiana

160.1 Games and Activities for Numerical Fluency
   3–5 Exhibitor Workshop
   Indiana Convention Center, Room 130
   A fast-paced, highly motivating workshop designed to help teachers engage all students in the classroom experience. Games help students develop mathematical skills to increase their positive identities as thinkers and learners of math. Participants will play games and discuss how games may be adapted.
   Big Ideas Learning, Erie, Pennsylvania

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1:00 p.m.–2:15 p.m.

161 Engage Early Learners and Promote Agency Using Interactive Simulations
PreK–2 Workshop
Indiana Convention Center, Room 236
All learners can feel engaged and empowered to build up number sense, compare representations, and reason about mathematics when using interactive simulations. Learn how to incorporate simulations into your K–2 classroom, facilitate inquiry-based activities or number talks, and engage learners in math practices.
Amanda McGarry, University of Colorado Boulder
Twitter: @McGarryMath

162 Assessment for All: How to Make Assessments Culturally Responsive
3–5 Workshop
Indiana Convention Center, Room 243–244
Culturally responsive teaching is a crucial component to providing all students with an equitable education. This session will explore this important but underrepresented aspect of culturally responsive pedagogy by sharing the results of panel discussions consisting of leaders who are defining and creating culturally responsive assessment.
Tammy Baumann, NWEA, Portland, Oregon
Sarah Whitney, NWEA, Portland, Oregon

163 Enhancing Students’ Global Awareness through Data Analysis
6–8 Workshop
Indiana Convention Center, Room 206–207
What do you know about the world you live in? In this session we will engage in a data analysis activity designed for students to engage in the statistical investigative process and increase their personal awareness of the global world they live in. Bring a laptop to engage with multiple tools for data collection and analysis!
Rick Hudson, University of Southern Indiana, Evansville
Twitter: @rickahudson

164 Why Do We Track Students? A Deep Look into Inequities in Ability Grouping and Barriers to De-Tracking
6–8 Workshop
Indiana Convention Center, Room 237–238
Tracking is a racist structure in mathematics education. As we push for equity reforms, we are constrained by the boundaries tracking creates. Calls for de-tracking are formidable, yet most schools continue to track students. This presentation will help participants learn the history of tracking and analyze their school’s barriers to de-tracking.
Stephanie White, University of Louisville, Prospect, Kentucky
Twitter: @mathleteKY

165 Interesting Ideas, Activities, and Manipulatives to Engage Students for Success in Geometry
8–10 Workshop
Indiana Convention Center, Room 233
Have fun and challenge yourself to use a variety of strategies, tools and resources to investigate new ideas, solve problems, and share mathematical ideas that can be used throughout the study of geometry. Participants will use household items with engaging problems to explore, develop, and apply geometric concepts and review geometry vocabulary.
Erin Schneider, Atherton High School, Jefferson County Public Schools, Louisville, Kentucky
Twitter: @MsSchneider018

166 Using Technology to Set the Pace for Online Collaboration Tasks
8–10 Workshop
Indiana Convention Center, Room 208–209
Come and explore meaningful tasks that allow students to collaborate while completing these activities in both synchronous and asynchronous environments. You will participate in activities from algebra 1 and Advanced Quantitative Reasoning (an algebra 2 equivalent course) using a diverse array of technologies. BYOD—any device is encouraged!
Erin Schultz, Ohio Connections Academy, Cincinnati
Twitter: @schultzem

167 The Five Practices in Practice: Overcoming the Challenges in Your High School Classroom
10–12 Workshop
Indiana Convention Center, Room 241–242
Fostering productive mathematics discourse in high school classrooms can be challenging! The recently-published Five Practices in Practice identifies 19 common challenges in orchestrating productive discussions using the Five Practices model. Using video and artifacts from high school classrooms, we will explore these challenges and how to overcome them.
Mike Steele, University of Wisconsin-Milwaukee, Zionsville, Indiana
Twitter: @midsteele47
## Friday Afternoon Workshops

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| 168 | Making Mathematics Content Courses Relevant for Preservice Secondary Mathematics Teachers | Coaches/Leaders/Teacher Educators Workshop  
Indiana Convention Center, Room 204  
In this session we share our experiences developing and implementing two math content courses for secondary mathematics teachers. These content courses make direct connections between the math the teachers will teach and their undergraduate level math courses. Come discuss middle school and high school math from an advanced perspective! | Elizabeth Brown, Indiana State University, Terre Haute  
Christine Taylor, Indiana State University, Terre Haute |
| 169 | Fluency Practice with Fractions and Decimals = More Than an Activity Sheet | 3–5 Workshop  
Indiana Convention Center, Room 234–235  
Fluency in mathematics involves more than automaticity with basic facts and computational procedures. It involves reasoning and strategic thinking. We will share instructional activities, routines, and games that target fractions and decimals and encourage work with all components of fluency: efficiency, flexibility, appropriateness, and accuracy. | Sherri Martinie, Kansas State University, Manhattan  
Jennifer Suh, Board of Directors, National Council of Teachers of Mathematics, Reston, Virginia; George Mason University, Fairfax, Virginia |

## Friday Afternoon Sessions

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| 171 | Elementary Mathematics Specialists: Connecting Math Teaching and Learning for Positive Change | 3–5 Session  
Indiana Convention Center, Sagamore Ballroom 5  
Elementary Mathematics Specialists (EMS) affect mathematics teaching and learning by enhancing the mathematical knowledge, teaching practices, and efficacy of elementary teachers. This session will provide an overview of the roles and work of EMS professionals. The presenters will share learning activities EMS may use as they work with teachers. | Marilyn Cannon, University of Central Missouri & Raytown School District, Warrensburg & Raytown  
Twitter: @m5cannon  
Ann McCoy, University of Central Missouri |
Indiana Convention Center, Room 245  
We will explore the foundations, purposes, and logistics of implementing a family math night in K–8 schools. Because these endeavors often involve both schools (practicing teachers) and universities (prospective teachers), we will share tips for setting up the collaboration as well as strategies for game choice and literature about outcomes. | Richard Busi, James Madison University, Harrisonburg, Virginia  
Mark Hogue, Slippery Rock University, Pennsylvania |
Friday Afternoon Sessions

173 Using Algebraic Structure to Design an Algebra Course
6–8 Session
Indiana Convention Center, Room 205
In this session, participants will discuss using algebraic structure to develop students’ conceptual understanding. The presentation will include examples of structure from the project and from participants. Participants will be provided three units to use with their students. Presenters will solicit feedback on the project and approach.

William Walker, Purdue University, West Lafayette, Indiana
David Feikes, Purdue University Northwest, Westville, Indiana
Natalie McGathey, Prairie State College, Chicago Heights, Illinois
Bir Kafle, Purdue University Northwest, Westville, Indiana

174 Using Differentiated Instruction to Teach Computation of Integers and Fractions and Solving Equations
6–8 Session
Indiana Convention Center, Sagamore Ballroom 3
Learn how to implement principles of differentiated instruction for teaching the computation of integers and fractions and solving equations incorporating the CRA approach. Participants will learn how to help students connect number and algebraic thinking including using properties of the operations to build number sense and computational fluency.

Joseph Sencibaugh, Webster University, Saint Louis, Missouri
Jennifer Bond, Ferguson-Florissant School District, Missouri

175 Whiteboard Modeling Methods
8–10 Session
Indiana Convention Center, Room 232
Attendees will learn and practice math modeling methods using whiteboards. The presentation will also cover the seven positive norms as expressed in Mathematical Mindsets by Jo Boaler and group work strategies from the CPM curriculum and the presenter’s own experience.

John Riley, Indianapolis Public Schools

176 Analyze and Graph Families of 15 Functions, 6 Transformations, Free Modular Course with 300+ Videos
10–12 Session
Indiana Convention Center, Room 239
Students learn to graph “by hand” 15+ parent functions with vertical/horizontal shifts, stretches, shrinks, reflections, f(-x), and combinations of these transformations. Proper terminology, domain, range. Strategies for in-class or online instruction, flipped classroom or as a review. 500+ colorful animated graphs for prealgebra through calculus.

Tom Reardon, Fitch High School/Youngstown State University, Poland, Ohio
Twitter: @tomreardon3

177 Assessment Interviews: Moving beyond Timed Test
General Interest Session
Indiana Convention Center, Room 231
Most fluency assessments focus on accuracy of facts. This session will highlight how to use student interviews to assess the other components of fluency: flexibility and efficiency. Tools for creating and conducting these assessments as well as data tracking tools to target specific need and provide prescriptive instruction will be shared.

Susan Loveless, Rutherford County Schools, Murfreesboro, Tennessee
Twitter: @susanloveless23

178 The Power of Students’ Ideas
General Interest Session
Indiana Convention Center, Sagamore Ballroom 4
Do all of your students believe that they have important mathematical ideas? Do they believe that mathematics makes sense and is about more than answers? We’ll explore routines and strategies for eliciting, valuing, and leveraging students’ ideas and discuss why being curious about students’ ideas is your most important job.

Annie Fetter, 21st Century Partnership for STEM Education, Rutledge, Pennsylvania
Twitter: @MFAnnie

178.1 Building Math Fluency Routine for Grades K–5
3–5 Exhibitor Workshop
Indiana Convention Center, Room 130
How can you build a math fluency routine that develops number sense and efficiency, flexibility, and accuracy with operations in just 10 minutes a day? We’ll experience how number strings and math talks can increase your students’ confidence in mathematics with hand2mind’s Daily Math Fluency program.

hand2mind, Vernon Hills, Illinois

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Discover more about NCTM’s Classroom Resources:
**Friday Afternoon Workshops**

2:45 p.m.–4:00 p.m.

### 180 Developing a Problem-Solving Culture in the Elementary Grades

**3–5 Workshop**
Indiana Convention Center, Room 243–244

Developing a problem-solving culture requires a combination of selecting challenging yet accessible problems and making appropriate instructional moves. We’ll investigate problems that can instigate mathematical excitement in the elementary grades. Come have some fun and find out what part you can play.

**Patrick Vennebush,** The Math Learning Center, Portland, Oregon
Twitter: @pvennebush

### 181 Make Mathematics Understandable and Relevant for ELLs: Accessing Language and Solving Word Problems

**3–5 Workshop**
Indiana Convention Center, Room 236

Are you looking for great ideas to help ELLs and other struggling students develop mathematics language and understand essential mathematical concepts? Come learn strategies to develop mathematics vocabulary, essential concepts and thinking and reasoning skills. Engage in real-life problem solving, and learn ideas to increase student engagement.

**Donna Knoell,** Shawnee Mission, Kansas
Twitter: @dknoell

### 182 Surfacing the Mathematical Thinking That Prompts Pólya’s Problem-Solving Strategies.

**6–8 Workshop**
Indiana Convention Center, Room 234–235

Have you ever wondered how the prodigy of problem solving decided which of his famous strategies to use? Are you curious about what he noticed and wondered as he made sense of a problem and devised a plan? If so, join us for a deep dive into mathematical thinking. Let’s do math together, share our reasoning, and expand our mathematical thinking.

**Grace Kelemanik,** Fostering Math Practices, Natick, Massachusetts
Twitter: @GraceKelemanik

**Amy Lucenta,** Natick, Massachusetts

### 183 Building Thinking Classrooms

**8–10 Workshop**
Indiana Convention Center, Room 237–238

In this session we will experience some of the thinking in classroom practices presented in Peter Liljedahl’s session on Building Thinking Classrooms. We will focus specifically on the types of tasks to use, random groupings, workspace, flow, and consolidation. These practices are for in K–grade 12.

**Will Dunn,** Topeka Public Schools, USD 501, Lawrence, Kansas
Twitter: @willmdunn

**Peter Liljedahl,** Simon Fraser University, Burnaby, British Columbia

### 184 Refresh with Engagement, Reflect through Mathematical Discourse, and Reconnect through Collaboration

**8–10 Workshop**
Indiana Convention Center, Room 233

Experience strategies that promote discourse while engaging with high-level tasks that promote productive struggle. Motivate students through the use of collaboration and shared thinking while implementing team roles, team norms, and study team and teaching strategies as you consider the role technology plays in supporting instruction.

**Kathryn Williams,** CPM Educational Program, Louisville, Kentucky
Twitter: @kwil518

**Theresa Reilly,** CPM Educational Program, Louisville, Kentucky

### 185 TECK: Technology Engaging Collaboration and Knowledge

**8–10 Workshop**
Indiana Convention Center, Room 206–207

Participants will engage in various online applications and experience these tools while learning, collaborating, discovering, and sharing mathematics. Through this workshop, participants will walk away with new or renewed interest in utilizing technology to break down barriers and open collaboration across space and time.

**Samantha McGlennen,** Southwest Allen County Schools, Fort Wayne, Indiana

**Betsy Berry,** Purdue University Fort Wayne, Indiana

### Collaborating and Engaging with Tools and Technology

Access and Equity Both Revealed and Revisited

Joy of Teaching, Learning, and Doing Mathematics

Teaching and Learning in the Current Era

Broadening the Purpose of Mathematics

Leveraging Assessments to Promote Student Learning and Improve Instructional Programs
Connecting Trigonometry and Geometry

10–12 Workshop
Indiana Convention Center, Room 208–209
The development of a Unit Circle will lead to an understanding of why geometric terminology has been extended to trigonometry. Terms such as cosine, secant, and tangent are typical trig terms that are rooted in geometry. We’ll begin with paper folding and conclude with a TI-Nspire CX demonstration as we make the connections that mystify students.

John Ashurst, Retired, Harlan Independent School District, Baxter, Kentucky
Twitter: @kiltedcyclist
Lindsay Gold, University of Dayton, Tipp City, Ohio
Gregory Foley, Ohio University, Athens

Teaching About Our World with Mathematical Models and Manipulatives

6 to 8 Workshop
Indiana Convention Center, Room 204
In this interdisciplinary workshop discover activities that bring current events and top global challenges into the math classroom. Explore trends in the environment, global population and more using models, manipulatives and lively group work that build middle school math skills while exciting students about math connections to their lives.

Meredith McAllister, Butler University, Indianapolis, Indiana

Coaching for Shifts in Classroom Practice That Promote Mathematical Proficiency

Coaches/Leaders/Teacher Educators Workshop
Indiana Convention Center, Room 241–242
Toward the goal of mathematical proficiency for all, participants will engage in a workshop around delivering instruction that encourages students to do mathematics and to build conceptual understandings. Our model marries lessons designed from challenging tasks with the LMP framework to promote shifts in classroom practice.

Crystal Walcott, Indiana University, Columbus
Michael Daiga, Wittenberg University, Dayton, Ohio
Doris Mohr, Ferdinand, Indiana
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Many related publications build on Principles to Actions and the toolkit.

Principles to Actions–related publications explore implementing the effective mathematics teaching practices; go in depth about the research behind Principles to Actions; and elaborate on such topics as access and equity, tools and technology, assessment, and more.

• Taking Action: Implementing Effective Mathematics Teaching Practices in—
  – Grades Pre-K–5
  – Grades 6–8
  – Grades 9–12

This set of grade-band books elaborates on the teaching and learning principles described in Principles to Actions. Each book provides examples and activities to help teachers develop their understanding of the eight effective mathematics teaching practices and how they can be enacted in the classroom.

• Enhancing Classroom Practice with Research behind “Principles to Actions”

This book summarizes and synthesizes the research behind each of the guiding principles and essential elements in Principles to Actions. It also provides examples of what this research might look like in classroom practice. This resource will provide readers with a sense of where the field stands in its knowledge and hypotheses about the big ideas put forth in Principles to Actions. In addition, it makes the principles and elements—as well as the research—concrete for readers by offering examples from classroom practice.

• Access and Equity: Promoting High-Quality Mathematics in—
  – Grades Pre-K–2
  – Grades 3–5
  – Grades 6–8
  – Grades 9–12

• Principles to Actions Elaboration Series
  – Access and Equity
  – Curriculum
  – Tools and Technology
  – Assessment
  – Professionalism