

2022
NCTM Research Conference

Program and Abstracts

September 28 -29, 2022
Los Angeles Convention Center

September 28, 2020 - 8:30 am - 9:45 AM

#101 - Opening Session - LA Convention Center - Room 511A

Reimagining One Mathematics, Many Voices- Our Stories, Our Research and the Resistance to a Previous Normal

These three inspiring speakers will share how they are thinking about their research today, its connections to rehumanizing mathematics teaching and learning, and the impact and power of this work. The panelists will make specific connections to the conference theme of linking research to practice and provide insights into some of the following questions. We invite you to grapple with these questions along with the panelists as we prepare for an engaging opening session.

Guiding questions:

- In what ways have you reimagined your research in light of our new realities?
- Have your definitions and conceptions of research and linking research to practice changed due to COVID-19, #BLM, other pandemics, and social inequities that plague this country? Talk about this journey and how your work looks different.
- How are you intentionally engaging and co-creating with your partners in light of their new realities?
- How must our partnerships change?
- How do we seize this opportunity to engage with partners and resist returning to normal?
- Have your conceptions of who is a practitioner, researcher, or partner changed as a result of our social and political context over the last few years?
- How do you co-construct mutually beneficial research agendas and products with teachers, families, partners, and other members of the community?
- The NCTM Position Statement on Linking Research to Practice states, “The relationship between research and practice is bidirectional in that research and practice communities have much to contribute to each other’s work (Arbaugh et al., 2010).” In what ways has your understanding of this bidirectional relationship grown (e.g., maybe it is now multidirectional) as you work to rehumanize mathematics teaching and learning?

Presenters

Michelle Lo, Campbell Union High School District

Marrielle Myers, Kennesaw State University

Farshid Safi, University of Central Florida

Jonee Wilson, Moderator, University of Virginia



Michelle Lo

Michelle Lo (she/her) is a high school mathematics teacher and continuous learner. As a recent graduate of the Stanford Teacher Education Program (STEP), she taught mathematics in San Jose for 2 years before moving here to Los Angeles and is interested in leveraging education as a space for learning and liberation. In particular, Michelle is interested in teaching mathematics as a means of civic engagement and social justice while improving STEM equity for girls, students of color, and multilingual students. She hopes to continue learning from and with others in her community and growing her teaching practice.

Her collaboration and work has been published in the *Journal of Urban Mathematics Education*. In 2021, Michelle and Dr. Teresa Dunleavy were awarded the NCTM MET 7-12 Classroom Research Grant as co-investigators on a project focusing on Complex Instruction and dismantling white supremacy culture.



Marrielle Myers

Dr. Marrielle Myers (she/her) is a tenured Associate Professor of elementary mathematics education and serves as the Director of Diversity, Equity, and Inclusion for the Bagwell College of Education at Kennesaw State University. Her research lies at the intersection of teaching mathematics for social justice, Political Conocimiento for Teaching Mathematics (PCTM), and supporting pre-service teachers' development of critical consciousness. Her current research project is funded by The Spencer Foundation and conducted in conjunction with colleagues at the University of Illinois Urbana Champaign and the University of Las Vegas at Nevada. Dr. Myers regularly presents her work at state, national, and international conferences.

In addition to publishing journal articles and book chapters, Dr. Myers regularly provides professional development with teachers in local schools (throughout Georgia) and international partner schools in Brazil, Trinidad and Tobago, and Ecuador.

Dr. Myers currently serves as a board member-at-large for The Association of Mathematics Teacher Educators (AMTE), a member of the National Council of Teachers of Mathematics (NCTM) research committee, and a board member for the Teachers' Development Group (TDG). Her commitment to diversity, equity, inclusion, and anti-racism frames her service work with these professional organizations.

Dr. Myers was the 2022 KSU Diversity and Inclusion award recipient. She was also an AMTE STaR fellow, a KSU EXCEL fellow, and the winner of the Early Career Award for the Bagwell College of Education.



Farshid Safi

Dr. Farshid Safi is an Associate Professor of K-12 Mathematics Education in the School of Teacher Education at the University of Central Florida in Orlando. His professional experiences include serving as a university teacher educator working with K-12 teachers & school districts for the last 20+ years. He is committed to learning with and from students and teachers at the elementary, middle grades and high schools while also teaching mathematics content and methods courses at universities throughout the U.S and Canada. As a public school teacher of students in mathematics, he has taught courses ranging from algebra to advanced placement calculus courses.

His research focuses on developing students and teachers' understanding of mathematics in coherent, conceptual, and connected ways with an emphasis on equitable teaching practices. He successfully engages with elementary and secondary teachers nationally and internationally in professional development efforts. He focuses on developing prospective teachers' conceptual understanding of elementary and secondary mathematics, as well as connecting mathematical topics through the intentional integration of technology and dynamic software in mathematical modeling.

Farshid frequently collaborates with mathematics education doctoral students and colleagues on books, book chapters and journal articles focused on reasoning and sense making, equitable teaching practices and mathematical literacy through a multi-disciplinary approach. He has presented at over a hundred state, national, and international conferences. He is a longstanding member of the National Council of Teachers of Mathematics (NCTM) and currently serves as a Board Member-at-Large for the Association of Mathematics Teacher Educators (AMTE).



Jonee Wilson

Jonee Wilson is at the University of Virginia's School of Education and Human Development. Her research focuses on examining and outlining instructional practices that empower and honor historically marginalized students specifically in the context of conceptually-oriented mathematics classrooms. She also focuses on professional development opportunities and other resources that support educators in learning, developing, and implementing such practices.

Dr. Wilson is leading a project that focuses on developing and validating classroom observation tools that attend to aspects of equitable mathematics teaching and learning. In her other current research projects, she is using what she is learning about equitable mathematics instruction to support school and district leaders, instructional coaches, and teachers as they work to understand and develop practices that aim for equity.

Wilson's work has been funded by the National Science Foundation and the Spencer Foundation. Her research has been featured in the Journal for Research in Mathematics Education, Urban Education, Journal of Mathematical Behavior, Teachers College Record, and the American Educational Research Journal. She received an early career publication award at the annual meeting of the American Educational Research Association (AERA) from the Research in Mathematics Education Special Interest Group in 2020.

10 AM - 11 AM

#201 - Research Paper - LA Convention Center - Room 512

Youth Digital Mathematics Stories: Eliciting Video Math Stories From Students of Color

Theodore Chao, The Ohio State University
Ho-Chieh Lin, The Ohio State University
Melissa Adams-Corral, California State University Stanislaus
Ayse Ozturk, The Ohio State University
Angga Hidayat, The Ohio State University
Ruth Oliwe, The Ohio State University

This research paper analyzes the process of engaging 18 youth in urban emergent communities to enact Digital Mathematics Storytelling to explore their mathematics identities. The youth, in grades 7-11, engaged in the process of crafting and sharing their digital mathematics stories within week long summer camps. Using a Participant and (Re)design Research Methodology, the research team explored how the constructs of Digital Storytelling, Mathematics Identity, and Storytelling can help us better know how to craft experiences that connect to youth knowledge.

#201 - Research Paper - LA Convention Center - Room 512

Developing political conocimiento: the journey of a mathematics teacher

Brenda Aguirre Ortega, University of Colorado Boulder
Victor Leos, University of Colorado Boulder
Tarah Donoghue, University of Colorado Boulder
Victoria Hand, University of Colorado Boulder

Mathematics teachers are being asked to attend to political dimensions of classroom learning. This study revealed how a professional development centered on anti-racist noticing practices, provided a space for practicing secondary mathematics teachers to develop political conocimiento (Gutiérrez, 2017). In the process of developing political conocimiento, tensions emerged as teachers engaged in activities designed to support noticing of their instructional practices through the lens of Critical Race Theory (CRT). The tensions were felt experiences that caused the teachers to pause and re-assess themselves, their students, classroom teaching, and mathematics education.

10 AM - 11 AM

#202 - Research Paper - LA Convention Center - Room 513

Lecture Capture in the World of Digital Natives: An Exploratory Study

Jonathan Engelman, Kettering College

This paper describes the qualitative phase of an exploratory sequential mixed methods study that addresses how lecture capture is used in college mathematics courses. The qualitative phase used a small sample to explore how students engaged with lecture capture. Students that experienced lecture capture were interviewed about how they used the lecture capture recordings. The Unified Theory of Acceptance and Use of Technology model was used to analyze this data. Three categories of lecture capture use were found. These results can then be used to inform a future quantitative phase in this research.

#202 - Research Paper - LA Convention Center - Room 513

Analyzing Learners' Behaviors with Mediated Modeling Actions Diagram

Jie Chao, The Concord Consortium
William Finzer, The Concord Consortium
Scott Cytacki, The Concord Consortium
Rose Zbiek, Penn State
Benjamin Galluzzo, Clarkson University
Rebecca Ellis, The Concord Consortium
Kenia Wiedemann, The Concord Consortium
Amy Brass, Penn State
Sarah Haavind, The Concord Consortium

Mathematical modeling is often characterized as a cyclic process that involves understanding the problem, simplifying and structuring the problem, mathematizing, working mathematically, interpreting the results, and validating the outcomes. With the increased use of computing tools in math modeling education, additional processes include converting the mathematical models into computational models, running, testing, and interpreting the computational results. These emerging technology-enriched learning processes are an active research area in math modeling education, yet, there is a lack of theory-based analytical instruments that can illuminate how tools and representations shape learners' modeling behaviors. The goal of this study was to develop an analytical instrument called Mediated Modeling Actions Diagram and test it with learner data to evaluate its usefulness. We present an analysis of a 40-second episode in a 9th-grade male student's modeling work with a diagrammatic programming tool. The episode involved unexpected transitions possibly attributable to the influence of the tools and representation. Using the diagram, we were able to understand the possible mechanism underlying the unexpected transitions. This diagram complements existing analytical tools by paying ultra-fine-grained attention to moment-by-moment interactions between the learner and the environment.

10 AM - 11 AM

#203 - Research Paper - LA Convention Center - Room 514

Mathematics Experiences of Preservice Elementary Teachers and the Impact on Mathematics Identity and Mathematics Teacher Identity

Fawnda Norman, University Of Wisconsin, Oshkosh

Many elementary teachers, who teach foundational mathematics topics, have a complicated and dynamic relationship with mathematics (Bekdemir, 2010; Brown et al., 2011; Novak & Tassell, 2017). The understanding of these mathematical experiences and the connection to mathematics identity is critical for the transformation of teacher preparation programs. Identity is dynamic in nature and is expressed and shaped by different factors, including social structures, emotions, narratives, and mathematics dispositions.

This qualitative study investigated the experiences preservice elementary teachers had with mathematics before entering their teacher preparation programs. A continuum of stories was collected about their mathematics experiences throughout their K-12 schooling. These narratives were examined to explore themes connecting their experiences to their current mathematics identity and their emerging mathematics teacher identity.

Narrative Inquiry was used to analyze the data of the preservice elementary teachers' experiences connecting to social structures, emotions, narratives, and mathematics dispositions, and the impact on their mathematics identity and mathematics teacher identity. Narratives and visual sequential narratives are used to present findings in a unique way connecting this research to broader audiences of scholars. The findings present themes and implications that contribute to the body of literature on mathematics identity and mathematics teacher identity.

#203 - Research Paper - LA Convention Center - Room 514

The Deep End of the Pool: Studying Early Undergraduate Research Experiences in Mathematics

Terrance Pendleton, Drake University
Sarah Sword, EDC
Anne Marie Marshall, Lehman College

The authors share preliminary findings from an investigation of the ways in which mathematics research projects, conducted early in students' undergraduate mathematical careers (often before precalculus) and around mathematical questions that students pose, can spark students' engagement and interest.

10 AM - 11 AM

#204 – Invited Session - LA Convention Center - Room 510

Leveraging International Perspectives to Maximize Mathematics Teacher Education Research

Gail Burrill, Michigan State University
Craig Willey, Indiana University- Purdue University

An International Congress on Mathematical Education (ICME) provides a venue for mathematics education researchers across the world to interact with an international community to share challenges and new ideas related to teaching and learning mathematics. ICME 14 provided a unique opportunity for US mathematics educators who received support from an NSF travel grant to learn from leaders in the field not only through their lectures but in personal discussion sessions in the US-ICME adaption of the Congress. These sessions provided the awardee with insights into challenges common across countries such as equity and access, the ways digital technologies are and are not being used to support learning, and how the field is addressing issues related to teacher preparation and learners with special needs.

11:15 AM - 12:15 PM

#301 - Research Paper - LA Convention Center - Room 510

Making Sense of Teachers' Knowledge of Students' Fraction Misunderstandings

Yasemin Copur-Gencturk, University of Southern California

John Ezaki, University of Southern California

Teachers' knowledge of students' misunderstandings is instrumental for effective teaching and student learning. However, there lacks a strong explanation of how this knowledge informs teachers' responses to students' misunderstandings. This study investigates 152 in-service elementary mathematics teachers' knowledge of students' misunderstandings of fractions and how different components of this knowledge impact their instructional decisions. First, we report how teachers characterized students' fraction misunderstandings, the source of the misunderstandings, and the subsequent instructional response. Then we use logistic regression to understand how teachers' instructional responses are predicted by their characterization of the students' struggles and the reasoning provided for those struggles. Our results indicate that conceptually explaining the misunderstanding and providing a mathematically grounded source of the error are both associated with a higher likelihood of providing an instructional response that is specific to the misunderstanding and aimed at building the students' conceptual understanding. Teachers' understandings of the reasons underlying students' misunderstandings has not been investigated in depth, yet appears to be an important component relating to their instruction. Thus, future work on teachers' knowledge of students and students' misunderstandings should consider the role of teachers' knowledge of why students struggle, as it may be a key lever affecting instructional decisions.

#301 - Research Paper - LA Convention Center - Room 510 - **Not Able to Present**

"I Understand It Even More Now, Despite I Used it All the Time." A Case Study on Toward a More Relational Understanding of A Fraction Comparison Strategy

Jinqing Liu, University of New Hampshire

Yuling Zhuang, Emporia State University

Research and policy documents suggest that preservice teachers (PSTs) are expected to possess a relational understanding (i.e., knowing how to do and why) of mathematics concepts and that relational understanding should be infused into all lessons. However, many PSTs could not successfully develop a relational understanding of fractions. This study aimed to shed light on how we can support preservice teachers' development of relational understanding through engaging them in writing collective argumentation in an online collaborative learning community in which we called WCAO. Specifically, we conducted a case study to explore to what extent engaging a PST in WCAO could promote the PST's relational understanding of fractions. We applied Toulmin's model to demonstrate the progress of a preservice teacher's relational understanding from both the structure and the content perspectives. The results indicated that after the engagement of WCAO, the PST had gained a more relational understanding of the common denominator strategy. It also suggested that Toulmin's model can be a useful tool to frame a person's development of relational understanding of mathematical concepts. Some educational implications for teacher professional development are provided.

11:15 AM - 12:15 PM

#302 - Research Paper - LA Convention Center - Room 512

Characterizing Multiple Dimensions of Algebraic Activity

Allison Gantt, University of Delaware
Teo Paoletti, University of Delaware

In the following paper, we present and apply a framework for characterizing multiple dimensions of learners' algebraic activity. In particular, we consider how tasks may elicit and learners may engage in combinations of quantitative reasoning, symbolization with algebraic symbols, and deductive reasoning to add nuance to our understanding of student activity in algebra. To illustrate the utility and considerations of this framework, we conducted a content analysis to characterize elementary pre-service teachers' (EPSTs') responses ($n = 42$) to a task they completed before beginning a mathematics course on algebra. We describe the distribution of responses across all regions of the framework, and provide examples to exemplify activity within each region. Finally, we discuss the implications of this characterization for our own design of equitable and responsive instruction. We also consider how the framework can serve as an important analytical tool for researchers and educators examining algebraic reasoning and supporting student thinking in algebra.

#302 - Research Paper - LA Convention Center - Room 512

Different Conceptions of Lines and Points in the Context of Graphing

Halil Tasova, California State University San Bernardino

In this study, I identified important differences in how students conceive points and lines. For example, students envisioned points as a circular dot that represents two quantities' measures and envisioned that points on a graph (e.g., a line) do not exist until they are physically and visually plotted. Therefore, they conceived the line as representing a direction of movement of a dot on a coordinate plane. On the contrary, students' meaning of a line included a record of two covarying quantities with the result of the trace consisting of infinitely many points, each of which represents both quantities' measures. I illustrate the role of these particular meanings for lines and points in students' construction and interpretation of continuous images of covariation in graphical contexts.

11:15 AM - 12:15 PM

#303 - Research Paper - LA Convention Center - Room 513

Motivational Wellness: Predicting Postsecondary Remedial Math Enrollment

Willian Neris, Florida International University
Remy Dou, Florida International University

Mathematics courses often present themselves as an insurmountable hurdle for students, particularly those marginalized by K-12 policies and practices. Many of these students find themselves taking remedial or developmental mathematics courses that add financial and temporal burdens. This context motivates our study of mathematics motivation and its potential for reimagining student success, not from the lens of academic "preparation", but rather from the perspective of socioemotional and affective wellness. Using Middleton's (2013) framework, we explore the relationship between motivational affect and traditionally defined measures of student success: high school mathematics GPA and enrollment in postsecondary remedial math courses. Specifically, we examine the relationship between these two outcomes and mathematics identity, interest, utility, self-efficacy, and effort using linear and logistic regressions with data from the High School Longitudinal Study of 2009 (N = 12,510). Our findings show that motivational variables measured during students' senior year in high school explain more than twice the variance in their mathematics GPA and enrollment in remedial math courses than self-reported gender, race/ethnicity, and primary language. We posit that these findings present an opportunity for K-12 teachers, curriculum developers, and administrators to center their efforts on students' motivational wellness when seeking to support their mathematics achievement.

#303 - Research Paper - LA Convention Center - Room 513

Disparities among Low SES Students in Relation to Math Teachers Perceptions and Expectations: A National Longitudinal Study

Guillermo Lopez, Claremont Graduate University

Mathematics is often perceived as a “ gatekeeper “ subject for many marginalized student populations. Although unique in their own ways, each of these marginalized students within their educational journeys encounter many common influences, known as influential others (Sewell and Hauser, 1980), that combined help shape the perception of themselves as mathematical students which previous research has shown to have direct effects on academic outcomes(Bandara,) . This study aims to focus on how Mathematics teachers play a key influential role on students, specifically students of low socioeconomic (SES) backgrounds, in relation to their own perceptions and expectations of other math teachers, student learning, and their math professional learning communities(PLC). The research questions this study aims to answer are: RQ1) Do math teachers expectations and perceptions differ based on student characteristics? RQ2) Whether and to what extent do math teachers' expectations and perceptions relate to student academic and psychological outcomes? RQ3) Whether and to what extent do math teachers' expectations and perceptions relate to student outcomes of Low SES students and is this relation moderated by Low SES students characteristics? This study has a sample size of 14,756 Math teachers and students that were surveyed using a National Longitudinal Study, HSLS:09.

11:15 AM - 12:15 PM

#304 - Research Paper - LA Convention Center - Room 514

Professional Growth, Challenges, and Equity Regarding Technology Integration in Secondary STEM Classrooms - **Not Able to Present**

Yi-Jung Lee, The University of Arkansas
Yuanlu Niu, The University of Arkansas

The authors reported on a study of 13 secondary STEM teachers (grades 5-12) who integrated educational technology (EdTech) into teaching during the COVID-19 pandemic. Their professional growth and challenges in the EdTech integration were analyzed via the TPACK framework (Koehler & Mishra, 2008). In addition, their perspectives on how EdTech integration affects equity through rehumanizing teaching and learning were depicted. The findings revealed that 1) STEM teachers could identify suitable technology, but their access to those STEM technology was limited; 2) when EdTech could be useful in teaching, STEM teachers were not satisfied with the relevant training; 3) students' implicit struggles while learning with EdTech affected teachers' instructional effectiveness, and 4) the technology support was not sufficient in most school districts. The educational and scholarly significance and implications in Mathematics education are discussed.

#304 - Research Paper - LA Convention Center - Room 514

Applying Expansive Framing to an Integrated Mathematics Computer Science Unit

Kimberly Beck, Utah State University
Jessica Shumway, Utah State University

School mathematics curricula in the United States often exist with distinct boundaries between subjects. This traditionally compartmentalized framing may lead learners to have a very limited view of the true depth and utility of mathematics. However, when content is framed expansively – across contexts, spaces, and times – learners may be better able to make broad connections to other ideas and ultimately transfer that content outside the classroom. Expansive Framing, which characterizes learning as a series of interrelated, overlapping ideas, provides a new way to conceptualize transfer between systems. In this paper, we explore the theory of Expansive Framing and its application to an interdisciplinary mathematics-computer science curricular unit. We present a pilot qualitative analysis of four artifacts in which we trace how content and context are framed expansively in lesson plans, and to what extent that framing carries over into classroom instruction.

11:15 AM - 12:15 PM

#305 - Interactive - LA Convention Center - Room 515A

Planning for Equity-oriented Math Tasks Using Design Principles for Community-based Mathematical Modeling and Lesson Study

Jennifer Suh, George Mason University
Holly Tate, George Mason University
Maryanne Rossbach, Fairfax County Public School
Samara Green, Fairfax County Public Schools

We designed a set of research based design principles for developing Community-based Mathematical Modeling Tasks which posed a planning prompt for teachers thinking about ways to deepen the learning both mathematically as well as in the realm of social justice. In this interactive session, together with the researchers and school practitioners, we will explore: 1) How do the Community based Mathematical Modeling design principles play a role in bringing mathematics to the forefront when exploring issues of social justice and equity? 2) How can we use the design principles to co-plan community mathematical modeling tasks that bring awareness and move students to take action on relatable community issues?

The design principles begin with a task situated in community issues. Teachers engage their students in mathematics and explore data to better understand the social issue which leads to the teacher posing a tractable math modeling task that helps make decisions towards a solution and taking action around the issue. By co-planning with researchers and school based practitioners, we will honor educators' knowledge of local issues and students interests and funds of knowledge while honoring researchers' knowledge in helping teachers plan using a lesson study structure.

12:30 - 1:30 PM

#401 - Poster - LA Convention Center - Room Petree C

Broadening Engagement, Participation, and Readiness in Mathematics

Laurie James, University of Hawaii-West O'ahu

Veny Liu, University of Hawai'i – West O'ahu

The project aims to enhance mathematical practices that increase the motivation and persistence of university students in the University of Hawai'i West O'ahu (UHWO) Teacher Preparation Program. This project proposes to implement a mentorship model that is structured after the American Institute for Mathematics (AIM) Math Teachers' Circles. This will bring together teacher candidates, teachers, and professional mathematicians to work on mathematically rich problems that would enhance participants' content understanding and problem-solving skills. The goal is to determine the effectiveness of evidence-based practices in teaching mathematics and to provide academic support for undergraduates in the Teacher Preparation Program at UHWO.

The 2021 Broadening Engagement, Participation, and Readiness in Education Research Project is supported by the National Science Foundation (NSF) funding and will look to improve the effectiveness of STEM education for all students. Through the interactive Math Teachers' Circle of Hawai'i (MaTCH) sessions, participants spend time discussing varied experiences to develop skills in anticipating their students' struggles and gain a deeper understanding of these mathematical processes through the direct experience of doing mathematics.

This project will provide academic and professional support that enhances the quality of undergraduate STEM education involving teacher candidates, faculty, and local math teachers in Hawai'i.

#402 - Poster - LA Convention Center - Room Petree C

Improv Teaching: Fostering Empowerment Through Purposeful Learning

Jung Colen, Chadron State College

Yong S. Colen, Indiana University of Pennsylvania

In our presentation, we focus on an important, but often overlooked opportunity: to acknowledge a student misconception and reconstruct it into a learning moment. To embrace learning opportunities for all students, we propose Improv Teaching: a responsive, flexible instruction that transforms an unexpected misconception into students doing authentic mathematics. This is a novel concept defined by the following three phases: (1) teacher discerns a relevant student misconception, (2) teacher and students probe for the underlying reasons behind the misconception, and (3) deviating from the lesson plan and incorporating the misconception, teacher empowers students through purposeful learning.

We will present a mathematics classroom where a teacher (Mr. K) selects a high-level, cognitively-demanding task and facilitates student-centered teaching practices. Throughout the lesson, the teacher leverages student-invented strategies to facilitate Improv Teaching, raise students' self-confidence, and take ownership of their learning.

12:30 - 1:30 PM

#403 - Poster - LA Convention Center - Room Petree C

Perceptions of Secondary Math Teachers in using an Intelligent Tutoring System as a Tool to Support Emergent Bilinguals' Math Learning

Betsy Araujo Grando, Iowa State University

This study aims to understand math teachers' perceptions of the use of Intelligent Tutoring Systems (ITS) to support Emergent Bilinguals' (EBs) mathematics learning. The EBs population in the public-school setting has shown a percentage increase each year (NCES, 2022). EBs present linguistical barriers while learning mathematics in and out of class time. Secondary math teachers need to perform multiple tasks to reach the diversity of their students and seek positive results for the school district's goals. A regular professional development might not be enough to provide the support and strategies these math teachers need to address the diverse background of the EBs in their classrooms. ITS can scaffold the content individually, giving feedback to the students while using the system. Most of these ITSs are designed with English language speakers in mind and without considering the teacher's needs to support their EBs students. With this study, I aim to understand from a math teacher's perspective if current ITS can facilitate EBs' math learning and support math teachers with their teaching tasks.

#404 - Poster - LA Convention Center - Room Petree C

Exploring Calculus Students' Opportunities To Learn the Concepts of Definite Integrals

Dae Hong, University of Iowa

This study explores calculus students' opportunities to learn the concepts of integral by examining one mathematician's videotaped lessons and the textbook. The results show that both lessons and textbook introduced important cognitive resources very briefly and focused on procedures and techniques of integration. Implications for these results were also discussed.

12:30 - 1:30 PM

#405 - Poster - LA Convention Center - Room Petree C

Examining College Calculus Instructors' Preferences and Potential Pedagogy in Teaching Derivative Graphs

Dae Hong, University of Iowa

This study examined college calculus instructors' preference in solving two calculus tasks to examine college calculus instructors' use of important cognitive roots in understanding the derivative of a function. Our results showed that only one instructor consistently uses cognitive roots while other instructors either focus on algebraic methods or express the constraints of students' knowledge, demonstrating their orientations and conflicts. These results potentially show what students experience when the derivative of a function is taught.

#406 - Poster - LA Convention Center - Room Petree C

Parent Mathematics Program: Enhancing Preservice Teachers' Pedagogy and Growth-mindset

Anh Pham, University of Texas at San Antonio
Bailey Devine, University of Texas at San Antonio
Emily Bonner, University of Texas at San Antonio

The Parent Mathematics Program (PMP) aims to enhance the teaching and learning of elementary mathematics and pedagogy through innovative, culturally responsive practices. The project provides free mathematics mentoring and tutoring programs via preservice teachers (PSTs) to parent scholars in low-income areas in a large, southwest city. This study explores outcomes for PSTs who have participated in PMP related to mathematics content, pedagogy, and growth mindset. The project provides training sessions for PSTs, beginning with a pretest followed by training sessions and capped with a posttest. PSTs are paired with a parent scholar to begin tutoring sessions. A senior faculty member of the project provide coaching and support to PSTs. The researchers used a multiphase mixed-method design (exploratory, triangulation, and enhancement phases). Quantitative and qualitative data were collected and analyzed to assess PST's learning and improvements in their pedagogy and growth mindset as a result of tutoring in the PMP.

12:30 - 1:30 PM

#407 - Poster - LA Convention Center - Room Petree C

Modeling and Representation: Preservice Teachers' Conception of Area and Perimeter

Reuben Asempapa, Penn State Harrisburg

This research study evaluated preservice teachers' (PSTs') use of mathematical modeling and skills of representation to solve an authentic modeling task focused on area and perimeter concepts. The research question explored centered on what models and skills of representation did PSTs use in solving a modeling task on area and perimeter concepts. The findings from the study indicated that PSTs continue to struggle with concepts centered on area and perimeter using modeling and skills of representation. Therefore, there is a need to develop PSTs' skills of models and representations and provide them with a variety of context to apply them creatively on area and perimeter concepts.

#408 - Poster - LA Convention Center - Room Petree C

African American Males' Lived Experiences in High School Math Classrooms

Lamont Holifield, University of Illinois - Chicago

This research seeks to understand African American males lived experiences in high school mathematics classrooms. Using their experiences, this research will look at black masculinity within mathematics education, which the author contends has been sporadic and spotty at best -- and there has been no nuanced articulation of the role of gender and race thereof. The researcher argues that we need theoretically rich and conceptually sound research on Black masculinity toward supporting young learners who identify specifically as Black boys in mathematics education.

12:30 - 1:30 PM

#409 - Poster - LA Convention Center - Room Petree C

On Black Family Mathematics Socialization during a Crisis: Studying Black Parental Responses to Remote Mathematics Teaching and Learning during the COVID-19 Pandemic

Anthony Thames, University of Illinois - Chicago
Gregory Larnell, University of Illinois - Chicago

The purpose of this study is to document and critically analyze the remote-schooling experiences of Black families with school-aged children--i.e. familial networks of home- and community-based caregivers, including parents and guardians--regarding K-12 mathematics during the COVID-19 pandemic. Drawing on existing research and theory concerning mathematics socialization, particularly among Black learners and families, the study is framed with questions about how families have responded to this remote-schooling moment with regard to the (re-)conceptualization of their roles as mathematics socialization agents and their capacities for strategizing and implementing supportive practices. This study consist of 6 participants that identify as Black/African American, and they are the parents/caregivers of children that identify as Black/African American. Each participant participated in two individual interviews, and all participants participated in a focus group that included all participants. Our primary goal is to generate findings that will contribute to understanding the complexities of mathematics socialization generally, during the pandemic specifically, and even more specifically, among Black parents/guardians and their school-aged children.

#410 - Poster - LA Convention Center - Room Petree C - **Not Able to Present**

Does Students' Number Sense Predict Grade-Level Math Learning?

Patrick Kirkland, University of Notre Dame Institute for Educational Initiatives

Students with mature number sense make sense of numbers and operations, use reasoning to notice patterns, and flexibly select the most effective and efficient problem-solving strategies (McIntosh et al., 1997). Despite being highlighted in national standards and policy documents (NCTM, 1989; NRC, 1989), the relationship between students' mature number sense and other important outcomes in mathematics education is not well defined in the literature. For example, is students' mature number sense predictive of their growth in grade-level mathematics achievement during a school year? In a longitudinal study, we analyzed 120 middle school students' growth in grade-level mathematics achievement over a school year. We predict that students' levels of mature number sense in the fall will be significantly predictive of their growth in grade-level achievement, even after controlling for their fall fraction and decimal knowledge. In this poster presentation, we will discuss complete findings from the study and how researchers

and educators can use our brief assessment of mature number sense to efficiently investigate middle school students' rich mathematical thinking.

12:30 - 1:30 PM

#411 - Poster - LA Convention Center - Room Petree C

Prospective Teachers Sense-Making of Humanizing Pedagogies in Math Classes

Sheila Orr, Michigan State University

This study draws on humanizing pedagogies (del Carmen Salazar, 2013) and caring with awareness (Bartell, 2011) to make sense of how prospective teachers articulate ways to create spaces in their classroom which will allow for students to feel supported. Through utilizing narrative analysis of written responses to scenarios and follow up focus group discussion, the voices of PTs are centered. Specifically, this study explores the following research questions: (1) How do secondary mathematics PTs imagine taking up humanizing, equity-oriented pedagogies in their future classrooms and (2) how are secondary mathematics PTs making sense of their experiences in their methods course with humanizing, equity-oriented pedagogies?

#412 - Poster - LA Convention Center - Room Petree C

Characterizing Mathematics Teacher Learning through Collegial Conversations in a Community of Practice

Amy Daniel, Montclair State University
Youngjun Kim, Montclair State University
Helene Leonard, Montclair State University
Victoria Bonaccorso, Montclair State University
Joseph DiNapoli, Montclair State University

This paper presents examples of collegial conversations among a group of secondary mathematics teachers participating in professional development in which they collectively investigated video cases of students engaging with high-quality instructional material. Employing the theoretical perspective of a community of practice and incorporating tenets of effective professional development, we leverage frame analysis to study the collective learning of a professional learning team through participants' changes in participation. These changes in participation were reified through conversations in which participants either contested others' ideas or transformed them into new ideas. Our findings suggest that while such conversations manifest in varying ways, they are all facilitated by a collegial environment in which teachers leverage candid discussions to productively support learning as a community.

12:30 - 1:30 PM

#413 - Poster - LA Convention Center - Room Petree C

Using Photovoice to Catalyze Mathematics Teacher Leaders' Professional Learning Design

Courtney Baker, George Mason University
Katherine Edwards, George Mason University

This qualitative study explores how photovoice (Wang & Burris, 1997) and an antiracist pedagogical framework (Moore, 2021) shaped the redesign of a mathematics specialist course assignment. Using Moore's antiracist pedagogical moves we explored the ways we were able to model vulnerability, shift agency, build community, and pose questions in the design and implementation of the professional learning course assignment. We applied self-study methodology to explore how our design decisions shaped the professional learning assignment and did (or did not) further the goals of antiracist and equitable mathematics teaching. Findings illuminate ways we productively struggled with enacting photovoice and the antiracist pedagogical moves in ways that our graduate students would then enact these moves within their own K-12 professional learning design. This work generates questions for the field around how mathematics teacher educators design and deliver professional learning that promotes Catalyzing Change (NCTM, 2018, 2020), in ways that honor the strengths and desires of K-12 school communities.

#414 - Poster - LA Convention Center - Room Petree C

Exploring Efficacy of Small School Teacher Leadership with Social Networks

Allison Olshefke, University of Notre Dame Institute for Educational Initiatives
Christine Trinter, University of Notre Dame Institute for Educational Initiatives

School leadership models that incorporate mathematics teacher leaders (specialists/coaches) have the potential to promote collaboration which strengthens professional learning and contributes to initiating and sustaining instructional improvement. However, beneficial outcomes rely on ensuring the contextual relevancy of these leadership models, and the majority of research on teacher leadership focuses on larger school systems with full-time teacher leaders trained through Master's degree or licensure programs. This project presents an alternative teacher leadership development and model that reimagines the traditional teacher leadership structure to accommodate the disparate needs of small school systems. Using social network data collected in 2022 alongside established findings from the math teacher leadership literature, collaboration will be used as the primary metric of comparison to begin to address a gap in the literature concerning the efficacy of professional development driven teacher leader training as well as the effectiveness of non-full-time teacher leaders.

12:30 - 1:30 PM

#415 - Poster - LA Convention Center - Room Petree C

The Cultural Relevance of High School Mathematics Curriculum

Jasmine Sourwine, Iowa State University

Culturally relevant pedagogy has been shown to positively impact students' performance and engagement. Most teachers largely base their lessons on curricula adopted at a district level, curricula that determine the content students are exposed to. This project explores the cultural relevance of one of the highest-ranked curricula in the United States, Illustrative Mathematics. The author explores the quantity and quality of efforts to include topics, context, and themes that are culturally relevant for non-dominant racial and ethnic groups. Teacher materials, student lessons, problem sets, and family support materials were analyzed and coded to describe the degree of cultural relevance in one unit of Illustrative Mathematics' Algebra I curriculum.

#416 - Poster - LA Convention Center - Room Petree C

Efficacy of Computer-Assisted Math Instruction in Elementary School: A Randomized Control Trial and Conceptual Replication

Matthew Foster, University of South Florida

Despite the surge in efficacy studies, the relative effectiveness of any two math interventions is largely unknown and replications are rare. To ensure that students benefit from high-quality learning experiences, the current conceptual replication of Wang and Woodworth (2011), a randomized control trial, evaluated the relative impacts of two computer programs used in a school district as supplements to students' regular education math instruction, DreamBox Learning and Zearn Math. For 115 students in kindergarten and first grade, data were collected before and after an 11-week implementation period. Measures of effect size, but not null hypothesis statistical tests, suggested that participants in the DreamBox condition had higher test scores on posttest numeracy and geometry (Hedges $g = .32$ and $.14$). There was also a statistically significant group by pretest interaction, evidence of "Matthew Effects" for numeracy. Although some support for adopting DreamBox as a supplemental method for improving math competencies of students in early elementary school was provided, more research is needed as the true effect may be smaller than what the present study reports. The study's implications are discussed.

12:30 - 1:30 PM

#417 - Poster - LA Convention Center - Room Petree C - **Not Able to Present**

Number Sense Misconceptions in the National Assessment of Educational Progress

Lisa Clark, American Institutes for Research
Amanda Mickus, American Institutes for Research

Numbers and number relationships are one of the foundations for all mathematical concepts. Misconceptions in these areas lead to mathematical errors in other topics. The National Assessment of Educational Progress (NAEP) provides data that can help explain the common misconceptions that lead to students' errors. Several of these common misunderstandings are illustrated by the examples provided on this poster. For each example item, student data is provided as well as an analysis of their results. Discussion questions are included to help teachers continue conversations about how these misconceptions can be addressed. Looking at how students answered NAEP items in the past can help us improve the mathematical understanding of students moving forward.

#418 - Poster - LA Convention Center - Room Petree C

A Longitudinal Study of Teachers' Knowledge Growth Through Teaching

Yasemin Copur-Gencturk, University of Southern California
Jingxian Li, University of Southern California

Teaching a particular subject provides rich opportunities for teachers to develop subject-specific knowledge and skills, especially for those who are in the early years of their career. Yet supporting evidence is scarce regarding the extent to which knowledge and skills teachers could gain from their own teaching practice. This study aims to address this gap by exploring the development teachers' pedagogical content knowledge (PCK) of mathematics. By analyzing data collected from a national sample of 207 novice mathematics teachers for three years in a row, we found that the teaching itself seemed to lead to the development of PCK, after accounting for other sources of teacher learning such as professional development and peer support. Furthermore, teachers with a more robust understanding of the school mathematics being taught developed PCK at a faster rate than did those with a less robust understanding. These findings provide empirical evidence that teachers learn through their teaching and that having a robust understanding of the subject matter plays a key role in developing the content-specific teaching expertise that is fundamental to student learning.

12:30 - 1:30 PM

#419 - Poster - LA Convention Center - Room Petree C

Designing Instruction to Support Middle School Students' Understanding of Adding and Subtracting Integers

Konda Luckau, Nebo School District
Daniel Siebert, Brigham Young University

Developing a deep understanding of integers and integer operations is an important focus in middle school mathematics. Recent research suggests that a deep understanding of integers includes fluency with multiple models for integers and several strategies for reasoning about integer operations. Drawing upon this research, we constructed a learning trajectory for developing a deep understanding of integers and integer addition and subtraction. We present our learning trajectory in this poster, which includes a set of detailed learning goals, developmental progressions that describe how students can build on their initial understandings to achieve the desired learning goals, and a sequence of tasks that support this development.

#420 - Poster - LA Convention Center - Room Petree C

Variable Types for Learning Functions in Middle School

Daniel Siebert, Brigham Young University
Ashlyn Rounds, Brigham Young University

For students to meaningfully learn about functions, they must develop fluency with the multiple ways variables are used to represent and solve problems related to functions. There is little research on which variable types are used when learning about functions, particularly when students are first introduced to functions in middle school. We conducted an analysis of two textbook series for 7th and 8th grade to identify the variable types used when reasoning about and solving problems related to functions. We found three general algebraic processes related to working with functions in the middle school textbooks, and each process involved multiple variable types. Furthermore, students were often required to reassign the variable types associated with symbols as they progressed through all three processes. We conclude that variable types may be an overlooked factor in students' struggle to learn functions.

12:30 - 1:30 PM

#421 - Poster - LA Convention Center - Room Petree C

Proximal Measures to Assess Learning in Professional Development

Chandra Orrill, University of Massachusetts Dartmouth
Yasemin Copur-Gencturk, University of Southern California

This poster considers the use of proximal and distal measures of teachers' knowledge to measure the effectiveness of a professional development program delivered through an intelligent tutoring system. In addition to administering existing assessments of teacher knowledge, the research team also developed assessment items that closely match the instruction being delivered. While both sets of assessments showed learning gains, the proximal assessment of content knowledge showed far more growth than any other measure. This poster will highlight differences in what is measured and how it can be used to help improve the instruction being delivered.

#422 - Poster - LA Convention Center - Room Petree C

Essential Elements: Facilitating Mathematics Inquiry in Online Environments

Kimberly White, Carroll University

Prior to COVID-19 and the shift to fully online instruction, teacher preparation programs were teaching candidates to use technology in the classroom, but what they were not focusing on was how to teach exclusively online or in hybrid models. In the future, all pre-service teachers will need to know how to teach online, whether due to necessity or by choice. Therefore, the purpose of our research is to first identify essential elements of critical digital pedagogy for facilitating online mathematical inquiry, and then to integrate these methods into our teacher preparation program to prepare pre-service teachers to facilitate inquiry-based mathematics effectively in online learning environments that are equitable and inclusive of all learners. We utilize a mixed-methods approach with quantitative and qualitative measures including literature reviews, individual interviews, focus groups, program documents, and efficacy surveys. Drawing on this data, this presentation shares the findings from the first part of this three-year research project by discussing essential elements of critical digital pedagogy for facilitating online mathematics inquiry. We identify what tools and instructional approaches can be used to support mathematical learning in online environments in ways that will support all students, including those who are traditionally marginalized in U.S. schools.

12:30 - 1:30 PM

#423 - Poster - LA Convention Center - Room Petree C

Preservice and Beginning Secondary Mathematics Teachers' Perspectives of Equity

Jennifer Wolfe, The University of Arizona
Anthony Fernandes, UNC Charlotte
Becca Jarnutowski, The University of Arizona
Rebecca McGraw, The University of Arizona

In this poster presentation, we share our preliminary analysis and findings of preservice and beginning secondary mathematics teachers' perspective of equity and equitable teaching practices. This work is part of a longitudinal study tracing the equity-related perspectives and emerging practices of 67 preservice and beginning secondary mathematics teachers. Through a constant-comparative analysis of five interview transcripts emerged 12 “equity associations” demonstrating how these five participants connected notions of equity to themselves and to their emerging practices. We will discuss and share these emerging 12 equity associations as well as participants' beliefs about the actions teachers can take to promote equity including rejecting deficit views and using complex instruction.

#424 - Poster - LA Convention Center - Room Petree C - **Not Able to Present**

Theorizing rightful presence in mathematical conversations, community, and classrooms

Paulo Tan, Johns Hopkins University

All of us will be or are impacted by disability. Yet, the disabled community, in general, and those of color in particular remains one of the most marginalized community in and out of schools. Building on the social-political turn in mathematics education and prior work with theorizing rightful presence in education, I propose an expanded theoretical framework for transformative changes toward equity and social justice in mathematical conversations, community, and classrooms. Core to this framework is the shift from inclusion to rightful presence as necessary in humanizing the mathematics education of/for/with disabled students, particularly those of color. Drawing on Black Feminists methodology, the expanded rightful presence framework is both theoretical and practical in centering notions of belongingness, solidarity, and interconnectedness toward immediate and unconditional justice & collective access. By theorizing rightful presence, I hope to contribute to elevating disability issues into larger conversations on educational inclusion, equity, and social justice.

12:30 - 1:30 PM

#425 - Poster - LA Convention Center - Room Petree C

A Study Examining How Teachers Handle Unproductive Mathematical Tricks

Jennifer Kornell, Clemson University

Nicole Bannister, Clemson University

This poster session defines the evolution of our study from the conceptual stage it is currently in, through the qualitative analysis, and to the findings generated in the study. The central theme of this study is how teachers who encounter students with previously learned unproductive mathematical tricks handle the instance and move the student forward mathematically with care.

Students who enter a new mathematics classroom with unproductive, previously learned tricks are disadvantaged mathematically. Ambitious mathematics teachers strive to develop robust mathematical learning aligned with NCTM's eight mathematics teaching practices for all students. Many teachers find it easier to assist students in unlearning the tricks and relearn the concepts before new learning than to build further understanding upon the procedural tricks.

This study examines unlearning and relearning from the emergent perspective that supports the goals of ambitious teaching as well as provides a framework to analyze the processes of unlearning and learning in a classroom. This study analyzes middle school mathematics teachers that practice ambitious teaching through video recordings of instances in which mathematical tricks are encountered in the classroom. Further, semi-structured interviews are conducted with the teachers to clarify and elucidate the findings.

#426 - Poster - LA Convention Center - Room Petree C

Math with a purpose: Designing a lesson to forefront contextualization

Rebecca Ellis, The Concord Consortium

Jie Chao, The Concord Consortium

Benjamin Galluzzo, Clarkson University

Rose Zbiek, Penn State

William Finzer, The Concord Consortium

Amy Brass, Penn State

Kenia Wiedemann, The Concord Consortium

Sarah Haavind, The Concord Consortium

Math modeling situates mathematics in real-life contexts (Garfunkel & Montgomery, 2019). It draws on students' abilities to take different perspectives as they examine the problem context and determine what factors are relevant to include for meeting a given goal. Using an accessible and relatable phenomenon (time students spend in school), we crafted a lesson with intentionally designed context variants and student grouping structures to highlight for students that which factors are relevant to include in a model depends on why the model is being built. In this session, we describe our lesson design and discuss how it can support students' development of the mathematical modeling competency of simplifying.

12:30 - 1:30 PM

#427 - Poster - LA Convention Center - Room Petree C - *Not Able to Present*

Using Technology Simulations With Secondary Mathematics Teacher Candidates –

Casedy Thomas, The University of Alabama -

Nationally, and within my institution's teacher education program, secondary teacher candidates (TCs) are often underprepared in classroom management, with consequences for their career longevity and their learners. TCs in our program have vocalized concerns with how to enact ambitious and responsive mathematics instruction while attending to classroom management. Mixed reality simulations have the potential to provide TCs with a safe environment to build their management skills. In this mixed-methods, pilot study, I incorporated simulated classroom management practice into my mathematics methods courses for a semester, with the intention of doing so for the next year. TCs engaged in simulations receiving individualized coaching, participated in focus groups, and completed pre and post surveys, providing valuable information on how TCs grow and learn from simulated practice. Some of the initial findings, include how TCs favorably viewed the simulations as influential learning opportunities despite the uncomfortableness that many of them experienced; these moments demonstrate important approximations of practice in which TCs saw the need to be more specific with their expectations for learners. Additionally, the majority of the participants discussed how building their self-efficacy with classroom management has positively impacted their perceptions of establishing mathematics discourse communities, giving more ownership to their learners.

#428 - Poster - LA Convention Center - Room Petree C

Fostering Communities of Inquiry: Supporting Teaching Presence in an Asynchronous, Online Professional Development Experience

Angela Knotts, WestEd

Asynchronous, online mathematics teacher professional development (PD) was designed to align with research in teacher professional learning as well as to support Communities of Inquiry (e.g., Garrison et al., 2000), particularly the element of teaching presence. The intervention included two actively facilitated formats and a structured independent condition, where facilitation was integrated into the design of the intervention. Participants' responses to intervention activities were analyzed using indicators of Garrison et al.'s Community of Inquiry (CoI) framework, seeking to understand the ways in which the intervention enabled a sense of teaching presence as well as participants' learning across facilitation formats. Analysis has implications for building the CoI framework into subsequent online asynchronous mathematics teacher PD as a way to effectively scale meaningful, high-quality professional learning and create greater access for more teachers, particularly those in marginalized or remote communities who are disparately impacted by barriers to participation in traditional, face-to-face professional learning offerings.

12:30 - 1:30 PM

#429 - Poster - LA Convention Center - Room Petree C

Multiple Representations of Functions in a Calculus Open Educational Resource Compared to a Traditional Textbook

Amy Daniel, Montclair State University

Open educational resources (OERs) have garnered much attention recently, as they carry with them a possible solution to the problem of overpriced college textbooks. However, ways in which to characterize the relative quality of these resources compared to traditional textbooks are needed. This research compares an OER calculus textbook to a widely adopted, traditionally-published textbook by examining the emphasis each text places on the coordination of multiple representations of functions in its student exercises. Between the two texts, 1,035 student tasks were analyzed and coded based on whether or not they required a coordination of functional representations, the kind of representations to be coordinated, and whether or not the coordination required perception or construction. The results reveal that the OER textbook was more likely to require students to make connections between multiple representations of functions than the traditional text. However, the traditional textbook was more likely to require the more cognitively demanding task of constructing a new representation from a given one, as opposed to asking students to perceive the relationship between two given representations.

#430 - Poster - LA Convention Center - Room Petree C

The Classroom Microculture and Productive Struggle

Tegan Nusser, Bradley Univ

This presentation will report on an analytic autoethnography that sought to investigate how a teacher negotiates a classroom environment that supports productive struggle. Recommendations for this environment do exist, however, how a teacher might go about establishing such an environment is less clear. This presentation will begin by discussing these recommendations and follow with how the initial negotiation of classroom norms progressed. The classroom microculture negotiated in this study will then be described using instructional episodes to demonstrate the connections between social norms, sociomathematical norms, classroom mathematical practices, and student struggle. Following, recommendations for supporting productive struggle from both the focus of classroom environments and episodes of struggle will be discussed. The presentation will conclude with how classroom microcultures (Cobb & Yackel, 1996) and the productive struggle framework (Warshuer, 2015) complement each other theoretically.

12:30 - 1:30 PM

#431 - Poster - LA Convention Center - Room Petree C

A Single Unified and Encompassing Method for Determining Various Cognitive Construction in Geometry Education

Emmanuel Nti-Asante, University of Massachusetts

In this poster, I conceptualized and explored a single approach for determining various cognitive constructions in geometry education.

#432 - Poster - LA Convention Center - Room Petree C

Eighth Grade Mathematics Acceleration: A Race to Nowhere?

Kimberly Dwyer, Stony Brook University

This study examines the performance of universally accelerated students versus selectively accelerated students in Algebra I in New York State. Data have been taken from the New York State Education Department's data site. Acceleration has been a topic in mathematics instruction for the last several decades. Calculus has long been considered the gateway course into higher level learning, which requires students to condense five years of high school mathematics into four years of high school. This analysis will use the term "universally accelerated" for districts in which 80% or more of the students are taking Algebra in eighth grade, while "selectively accelerated" districts will refer to those that have between 0% and 30% of eighth grade students taking Algebra in eighth grade. This research aims to determine whether students who are universally accelerated in Algebra I achieve at the same level as their non-accelerated peers. In other words, is choosing to universally accelerate in eighth grade helping our students in the way we expect?

12:30 - 1:30 PM

#433 - Poster - LA Convention Center - Room Petree C

The Treatment of Coordinate Graphing Conventions in Early Algebra

Ingrid Ristroph, The University of Texas at Austin

The treatment of mathematical conventions has been taken for granted at the elementary level. This study reports on the ways in which elementary teachers introduce and treat coordinate graphing conventions. An analysis of 12 video observations of teachers from grade 4 as they implement a common early algebra lesson is guided by the following questions: To what extent are coordinate graphing conventions acknowledged as such by teachers? To whom, if anyone, are the conventions attributed? What are the ways in which teachers delegate authority, if at all, to students to explore coordinate graphing conventions or generate possible alternatives to established graphing conventions? Preliminary findings show that teachers by in large do not acknowledge conventions as such, and when do they attribute conventions ambiguously to others by use of “they”, “people”, and “mathematicians”. In one case, a teacher delegated authority to students by asking students to generate alternatives to the established graphing conventions.

#434 - Poster - LA Convention Center - Room Petree C

Association between Non-Cognitive Factors and Mathematics Achievement

Kyunghoon Son, Boston College
Lillie Albert, Boston College

Recent Studies argue that students’ non-cognitive factors contribute equally to mathematics performances than their cognitive factors. Policymakers and scholars suggested various resolutions to mitigate the U.S students’ underperformance in mathematics; however, it should be more important to diagnose what factors are associated with students’ mathematics performance prior to finding and providing effective solutions. Thus, this study investigated the extent to which non-cognitive factors were associated with U.S. students’ mathematics achievement compared to other outperforming countries. A 3-level hierarchical linear modeling was applied to analyze the association between non-cognitive factors and mathematics achievement found in the Trends in Mathematics and Science Study 2019. For non-cognitive factors, the modeling process included two psychological individual-level factors (i.e., sense of belonging and confidence in mathematics) and four environmental class-and school-level factors (i.e., academic performance uniformity, teachers’ mathematical knowledge for teaching, school socioeconomic status composition, and mathematics resources accessibility) in the modeling. The result found that students’ sense of belonging and confidence in mathematics were significantly associated with students’ mathematics achievement across five countries. However, the association between class-and school-level factors and mathematics achievements varied among countries. This study discussed the association found in the U.S. data with comparison to the other four outperforming countries.

12:30 - 1:30 PM

#435 - Poster - LA Convention Center - Room Petree C

A Math Program's Online Impact on Student Results on Benchmark Assessments

Debbie Waggoner, Fayette County Public Schools

This study investigates an online math program's impact on benchmark testing. The study aims to see if there is a correlation between the amount of time students spend on the online portion of the enVision math program to their scores on the NWEA MAP math universal screener or the Imagine Math Galileo math standards mastery test. The study will also determine if there are differences in assessment scores for students using the online math program by demographic groups: sex, race, socioeconomic status, disability or grade. Cognitive information processing theory, growth mindset as well as use of scaffolds with immediate feedback and use of data for change all form the conceptual framework. Archival data from Spring of 2022 testing from the assessments and program usage from the 2021-2022 school year will be analyzed during the summer of 2022 with results to be shared at this conference. Scores used for analysis are from students in elementary grades 3-5 and middle school grades 6-8 from a district with over 50% non-white students and 50% of students on free or reduced lunch. Results may indicate whether more online program usage is related to higher test scores or not, and if results vary by demographics.

1:45 PM - 2:45 PM

#501 - Research Paper - LA Convention Center - Room 510

Teachers' Questioning Techniques in Mathematics Field Experiences- **Not Able to Present**

Yi-Jung Lee, The University of Arkansas

The author reports on a study of 13 preservice elementary school teachers' questioning techniques in early Mathematics Field Experiences (MFE). The findings not only provided a holistic analysis of the types and level of openness of the enacted questions but also revealed influential features in preservice teachers' questioning. Furthermore, the author addresses how closely interacting with students facilitated teachers' use of questioning in MFE and discusses the educational significance of the study

#501 - Research Paper - LA Convention Center - Room 510

The "Origins" of Potential Sociopedagogical Norms in Mathematics Teachers' Online Asynchronous Discussions

Anthony Matranga, California State University San Marcos
Jason Silverman, Drexel University

Generative norms are an important component of professional learning environments that support teachers in developing mathematical and pedagogical discourse and practice. This study aimed to understand how potential sociopedagogical norms for engaging in online asynchronous discussions initially emerged and diffused through mathematics teachers' social network. We studied 16 mathematics teachers participating in an online course focused on NCTM recommended instructional practices. We used social network analysis to construct a "two-mode" network to examine associations between the features of participants' pedagogical discourse and their membership with the core and the periphery of the network. Our findings show that the core of the network had a larger role in establishing potential sociopedagogical norms for engaging in online discussions. We argue that this work is the foundation of pedagogical innovations that use computational tools to process teacher interactions and support teacher educators in shaping emerging norms for collaboration in online discussions.

1:45 PM - 2:45 PM

#502 - Research Paper - LA Convention Center - Room 512

A Decomposition of the Teaching Practice of Building

Keith R. Leatham, Brigham Young University
Laura Van Zoest, Western Michigan University
Blake Peterson, Brigham Young University
Shari Stockero, Michigan Technological University

We share a decomposition of building on HLIs (blinded construct)—a teaching practice that takes advantage of high-leverage instances of student mathematical contributions made during whole-class interaction. This decomposition resulted from an iterative process of teacher-researchers enacting conceptions of the building teaching practice that were refined based on our study of their enactments. We elaborate the four elements of building: (a) Establish the student mathematics of the HLI as the object to be discussed; (b) Grapple Toss that object in a way that positions the class to make sense of it; (c) Conduct a whole-class discussion that supports the students in making sense of the student mathematics of the HLI; and (d) Make Explicit the important mathematical idea from the discussion. We argue for the value of this practice in improving in-the-moment use of high-leverage student mathematical thinking during instruction.

#502 - Research Paper - LA Convention Center - Room 512

Understanding Coded Language in Mathematics Education through Conversational Pragmatics

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

Recent work in mathematics education research (Shah et al., 2021) has identified the phenomenon of coded language as a significant concern with regard to educational equity. This is language that contains no explicit derogatory content, but that denigrates targeted social groups, nonetheless. Coded language is prevalent in both the classroom and research publications but is hard to spot or combat. This makes better understanding it a crucial research project. The present paper shows how the tools of conversational pragmatics, taken from philosophy of language, can provide a systematic account of one aspect of coded language: conversational implicature. Providing a clear account of this strand of coded language aids us in understanding and combating the phenomenon.

1:45 PM - 2:45 PM

#503 - Research Paper - LA Convention Center - Room 513

Increasing Math Voices of Emergent Bilinguals by Implementing 5-Act Tasks

Ji-Yeong I, Iowa State University
Coskun Erden, Iowa State University
Jasmine Sourwine, Iowa State University
Betsy Araujo Grando, Iowa State University

This study is based on the belief that Emergent Bilinguals are capable of rigorous mathematics. While providing Emergent Bilinguals with rigorous math tasks, the quality of instruction of the math teacher was examined using the Mathematical Quality of Instruction scale and Quality of Linguistically Diverse Teaching rubric. The intervention for the teacher involved situated professional development (situ-PD), which applies co-planning, co-teaching, and co-analyzing between a researcher and a teacher. We aim to investigate how the high school teacher's mathematical instruction and students' participation changed when situ-PD and 5-Act Tasks were applied. The data was obtained from an ELL-Algebra 1 class with a first-generation immigrant bilingual teacher. The comparison of a teacher-only lesson before the intervention and the co-taught lesson after one semester of the situ-PD revealed a meaningful impact of the situ-PD and 5-Act Task. Students' explanations and engagement in mathematical discussions grew, and instructor interactions and connections with EBs increased.

#503 - Research Paper - LA Convention Center - Room 513

A Professional Development with a Virtual Facilitator on Proportional Reasoning

Sebnem Atabas, University of Southern California
Yasemin Copur-Gencturk, University of Southern California

Proportional reasoning is at the heart of the middle school curriculum, with a wide range of applications in school mathematics (Hoyles et al., 2001). Despite its significance, it is well documented that teachers often struggle in understanding and teaching this topic (Modestou & Gagatsis, 2010). A key strategy for overcoming this struggle is to enhance teachers' content knowledge and pedagogical content knowledge (National Mathematics Advisory Panel [NMAP], 2008) through professional development programs. We developed a computer-based program with a virtual facilitator affording immediate feedback and responsive interactions to scale up effective professional development programs. The program uses a form of artificial intelligence to diagnose teachers' responses and provide adaptive, just-in-time feedback. To examine the effectiveness of the program, we collected data from 37 middle school teachers—20 teachers in the treatment group and 17 teachers in the control group. All the teachers participating in the study provided four assignments they used to teach proportional reasoning concepts along with sample student responses. We analyzed student work samples by using scoring rubrics for student work collections (Boston, 2012; Matsumura et al., 2008). Results showed significant differences between the treatment and control groups, which show evidence of teacher learning from the program.

1:45 PM - 2:45 PM

#504 - Research Paper - LA Convention Center - Room 514

With great power comes great responsibility: Ethical reasoning of students in the big data era

Stephan Michelle, UNC Charlotte
Jordan Register, UNC Charlotte
Luke Reinke, UNC Charlotte
David Pugalee, UNC Charlotte
Christine Robinson, UNC Charlotte
Premkumar Pugalenthi, UNC Charlotte

Big Data Analytics have changed the way organizations conduct business. Companies and non-profits now have the ability to collect or purchase millions of pieces of data on consumers or clients, enabling them to investigate avenues to increase capital much faster and cheaper than ever before. Since the majority of data scientists come from privileged populations, discriminatory practices, whether intentional or not, are the consequence of the biases coded within the algorithms and mathematical models. For this reason, ethical reasoning in mathematics must become integrated throughout K-12 mathematics instruction. This paper describes the result of a pilot study in which we explored the ethical reasoning of adolescents on a variety of mathematics problems that were designed to involve ethical dilemmas.

#504 - Research Paper - LA Convention Center - Room 514

Functions Learning Progressions and Mathematics for Social Justice: A Textbook Analysis

Katherine Edwards, George Mason University

The goal of this textbook analysis was to investigate how Learning Progressions and Teaching Mathematics for Social Justice can complement one another to support effective and equitable high school mathematics instruction. Using Gutiérrez's (2009) framework as an analytical lens, I examined five functions tasks from High School Mathematics Lessons to Explore, Understand, and Respond to Social Injustice

(Berry et al., 2020) using a functions learning progression (Wilmot et al., 2011) and a Culturally Responsive Mathematics Teaching Lesson Analysis Tool (Aguirre & Zavala, 2013). Findings indicate that the tasks, as written, have strong potential to provide: (1) access to rigorous mathematics, (2) opportunities to demonstrate mathematical achievement, (3) meaningful connections to student identity, and (4) space to exercise power in the classroom and wider community. Still, nuances in the coding and analysis process revealed possible areas for improvement, which I use to suggest recommendations for curriculum designers, teachers, administrators, and researchers.

1:45 PM - 2:45 PM

#505 - Interactive - LA Convention Center - Room 515A

Using Complex Instruction to Dismantle White Supremacy Culture

Michelle Lo, Campbell Union High School District
Teresa Dunleavy, Antioch University

Our discussion session features a mathematics teacher educator and a high school mathematics teacher who sought to investigate how aspects of White Supremacy Culture both appear and can be dismantled as part of mathematics complex instruction. We will share transcript and video of classroom interactions from our research and pose discussion questions that interrogate the presence of WSC during collaborative learning. Our questions include: 1) What features of mathematics CI tasks challenge the characteristics of WSC? And 2) How does a teacher use the pedagogical structures of CI to dismantle WSC, a) through how the mathematics tasks are implemented? and b) through peer-to-peer interactions that take place during groupworthy tasks? In this session, we will identify the characteristics of WSC, their definitions, and we will bring classroom data to analyze the task features (Q1) and peer-to-peer discourse (Q2) that may facilitate the discussion.

3:00 PM - 4:00 PM

#601 - Research Paper - LA Convention Center - Room 510

Teacher Comfort and Preparedness as the Foundation for Equitable Classroom Practices

Teresa Duncan, Deacon Hill Research Associates
Babette Moeller, EDC
Jason Schoeneberger, ICF
John Hitchcock, Westat

Teacher quality, along with the school context, classroom practice, and student mathematics achievement, are the key components in Clarke & Hollingsworth's 2002 model that depicts teachers' professional growth as an ongoing, dynamic, and interactive enterprise. Comfort and preparedness are dispositions that along with teacher knowledge comprise aspects of teacher quality. This model provides a basis for proposing a specific causal mechanism: professional development designed to help teachers understand and respond to individual students' strengths and needs should support classroom equity by increasing teachers' preparedness and comfort, which in turn enhances the likelihood of teachers' engaging in differentiated instruction to support all students. This paper draws from two randomized controlled trials of [Redacted], which show consistent, positive results of the program on elementary school teachers' reports of comfort and preparedness to teach mathematics to diverse students – across modes of delivery, grade levels, and to a lesser extent, locales. We also found comfort and preparedness to be modestly but consistently related to self-reported mathematical instructional practices across both studies. These results point to the consistency of the positive effects across sub-samples, and to the scalability of the [Redacted] program.

#601 - Research Paper - LA Convention Center - Room 510

Examining Mediating Elements of Culturally Responsive Mathematics Teaching - Not Able to Present

Casedy Thomas, The University of Alabama

This qualitative study uses Cultural-Historical Activity Theory (CHAT) as a theoretical lens to examine mediating factors that influence the implementation of culturally responsive teaching (CRT). The focal district in this study offers teachers CRT certification through professional development opportunities and involvement in communities of practice. A multi-case study nested within the larger study was conducted to investigate particular elements in the activity system that were impacting the elementary mathematics instruction of three district-level, CRT certified teachers. Data were collected through observations, interviews, journal protocols, questionnaires, and artifacts. The findings illustrate how elements of CHAT such as tools, divisions of labor (structural supports), communities of practice, and rules were mediating the teachers' delivery of CRT and their perceptions of such elements.

3:00 PM - 4:00 PM

#602 - Research Paper - LA Convention Center - Room 512

Teachers' Knowledge of Students' Struggles and its Relation to Achievement

John Ezaki, University of Southern California

This study measured a sample of 50 in-service middle school mathematics teachers and over 1,000 students to understand the relationship between teachers' knowledge of students' misunderstandings (KOSM) and student achievement for ratios and proportional relationships. The study built on the previous methodology used to assess teachers' KOSM by asking teachers not only to predict common student misunderstandings but also to explain the source(s) of the misunderstanding(s). To analyze the data, latent class analysis was used to understand if there were different groupings of teachers based on their knowledge of students' misunderstandings and how they differed based on their responses. Hierarchical linear modeling was used to investigate the relationship between how teachers' content knowledge, teachers' KOSM, and teachers' background characteristics relate to student achievement. This study provides a more refined measure of teachers' KOSM and provides more empirical evidence for the importance of teachers' KOSM. This work can inform the development of teachers so that they are trained to consider not only when students will make mistakes, but also why they make those mistakes, which is important for effective instruction.

#602 - Research Paper - LA Convention Center - Room 512

How "Mathematical" Are Elementary Preservice Teachers' Whole Number Representations?

Raymond Flores, Texas Tech University
Jian Wang, Texas Tech University
Minju Yi, Texas Tech University

While the appropriate use of mathematical representations is assumed to be shaped by the kinds and nature of mathematics topics, elementary preservice teachers are often expected to develop effective representations for teaching mathematics in general. Drawing on video-taped teaching data from 90 elementary preservice teachers, this study examined the types and quality of elementary preservice teachers' representations for teaching whole numbers in terms of precision, clarity, and explicit alignment to mathematics concepts and procedures. It found that while the overall quality of preservice teachers' whole number representations was high, the types of representations and quality of their representations varied across mathematical topics taught in lower and upper elementary grades.

3:00 PM - 4:00 PM

#603 - Research Paper - LA Convention Center - Room 513

A Trajectory Along Which Teachers Grow as Modelers and Teachers of Modeling

Rose Zbiek, Penn State
Susan Peters, University of Louisville
Benjamin Galluzzo, Clarkson University
Amy Brass, Penn State
Stephanie White, University of Louisville
Jie Chao, The Concord Consortium

Teachers learn how to do and teach mathematical modeling over time. Studies of designed professional learning interventions target the effects of specific and often formal experiences. In this study, we complement existing research by looking across the multitude of formal and informal experiences that teachers accumulate as we explore secondary mathematics teachers' perceptions of the experiences that contributed to their capacities to understand mathematical modeling and to facilitate students' modeling experiences. Our use of retrospective research methods and transformative learning theory intentionally honors teachers as adult learners and values their perspectives while providing a way to study the complexity of learning to model and to teach modeling. Data analysis identifies triggers and knowledge dilemmas that prompted teacher learning as we explore how teachers resolved dilemmas. Themes and patterns in experiences reveal a trajectory for teacher learning. We share how a subsequent study is validating the trajectory, which both supports and challenges common content and practices in teacher education. The study also illustrates the usefulness of retrospective methods to understand teachers as lifelong learners and underscores the value of hearing their voices.

#603 - Research Paper - LA Convention Center - Room 513

Enhancing Exploration and Conjecture Construction through Identifying Patterns by the Use of Technology

Shahabeddin Abbaspour Tazehkand, University of Central Florida
Farshid Safi, University of Central Florida

Proving statements is a mathematical process that includes different steps and involves different kinds of reasoning. The first three steps of this process are exploration, discovery, and conjecture, which require students to use inductive reasoning. To grasp a good understanding of the last two phases in the process of proving (proof and certification), students need to have enough engaging experiences with the first three phases. It can be said that despite the fact that students get exposed to conjectures and work on activities in which they determine if a conjecture holds true or not, they are not often the ones who construct the conjectures, especially in high school. One reason is that they don't get the right instruments and enough time to explore the concepts. This study investigates different factors such as visually representing ideas, use of technology, and background experiences with exploration and conjectures in understanding patterns and series, and how those factors play a role in building the foundational knowledge and skills necessary for mathematical proofs.

3:00 PM - 4:00 PM

#604 - Research Paper - LA Convention Center - Room 514

Computational Thinking: Perspectives of Preservice K-8 Mathematics Teachers

Angela Barlow, University of Central Arkansas
Elizabeth Barlow, Auburn University
Louis Nadelson, University of Central Arkansas

Computational thinking is a cross-curricular skill, utilized in solving problems from diverse disciplines. Given its requirements to engage in problem posing, problem solving, and mathematical modeling, mathematics courses are considered a reasonable context for advancing student knowledge of computational thinking. Therefore, it is imperative that mathematics educators grapple with the distinction between the instructional goals in mathematics and the processes associated with computational thinking. Further, these distinctions must be considered in planning mathematics instruction that aims to include computational thinking.

With this as our backdrop, the purpose of this study was to investigate preservice K-8 teachers' views of computational thinking. Analyses of qualitative data collected via an online simulation revealed that preservice teachers felt that teaching computational thinking was important for reasons that included: preparing students for the future, improving capacity for reasoning and problem solving, and providing students equal opportunities. Within their responses, preservice teachers often displayed deficit thinking and described different learning outcomes for different students, while a small number demonstrated a belief that all students are capable of engaging in computational thinking. Presenters will feature the online simulation used in data collection. Implications for mathematics teacher preparation will be discussed.

#604 - Research Paper - LA Convention Center - Room 514

Unpacking Noticing and Wondering and its Impact on Instruction

Jason Silverman, Drexel University
Anthony Matranga, California State University San Marcos
Wesley Shumar, Drexel University
Valerie Klein, Drexel University
Amanda Reinsburrow, Drexel University

We report on teachers' descriptions of instruction featuring Noticing and Wondering as a pedagogical strategy, share themes that emerged from this analysis and discuss the potential implications of these emergent themes for the design of teacher professional development.

3:00 PM - 4:00 PM

#605 - Invited - LA Convention Center - Room 511A

Getting published in JRME and MTE, and more

Patricio Herbst, Editor in Chief, *Journal for Research in Mathematics Education*
University of Michigan

Michael Steele, Editor in Chief, *Mathematics Teacher Educator*

Come and meet and learn from the editors of the *Journal for Research in Mathematics Education* and the *Mathematics Teacher Educator* about the submission, review, and publishing processes of each.

Along with presentations from each editor, there will be time for questions and discussion about developing manuscripts and using review feedback. Bring your thoughts and idea.

3:00 PM - 4:00 PM

#606 - Interactive - LA Convention Center - Room 515A

Envisioning the use of Instructional Videos to Support Mathematics Discourse

John Gruver, Michigan Technological University

Mike Foster, San Diego State University

Joanne Lobato, San Diego State University

The amount of online mathematics videos has ballooned over the last decade and a half. This proliferation of online instructional videos has the potential to provide a breadth of students with open access to mathematics learning experiences. However, simply watching an online video does not equate to having a meaningful learning experience. Thus, participants in this session will explore the following question. How can instructional mathematics videos be leveraged to stimulate discussion around conceptually rich mathematical content? To explore this question, participants will sketch lesson plans intended to make use of the affordances of a variety of types of instructional videos. Participants will discuss the various lessons and examine how different lessons effectively made use of these affordances to support meaningful mathematics discussions in secondary classrooms.

4:15 PM - 5:15 PM

#701 - Research Paper - LA Convention Center - Room 510

Multiplicative Reasoning: Students with Difficulties in Mathematics – **Not able to present**

Barbara Dougherty, University of Hawaii
Asha Jitendra, University of California, Riverside,
Victoria Sanchez, University of California, Riverside

Multiplicative reasoning is essential in developing and understanding mathematical concepts relative to relationships between and among numbers. It is the underpinning of rational numbers, ratios, and proportions.

In this presentation, we will share results from a three-year development project (funded by IES), in which an implementation science approach was used to develop a multiplicative reasoning intervention for Tier 2 instruction. It focuses on whole number multiplication and division to build multiplicative reasoning and enhance the mathematics performance of third-grade students with mathematics difficulties.

The presentation will include details about our collaboration with third-grade teachers to examine the usability and feasibility of the intervention for use with students in the Tier instruction. Participants will learn about the instructional components of the intervention and its potential to improve student learning of multiplication and division as we share data on student performance on progress monitoring and a multiplicative reasoning assessment and student and teacher satisfaction with the intervention content and instructional approach.

#701 - Research Paper - LA Convention Center - Room 510

Cultivating civic empathy and equity with mathematical modeling and culturally responsive math teaching: A first-grade case study

Jennifer Suh, George Mason University
Julia Aguirre, University of Washington Tacoma
Holly Tate, George Mason University
Erin Turner, The University of Arizona
Mary Alice Carlson, Montana State University
Elizabeth Fulton, Montana State University

In this paper we use a CRMT framework to analyze a case study of a community-based modeling lesson in a first grade classroom. The modeling task asks students to investigate cultural/racial diversity of books in the class library and whether the library collection is fair. The following research question guided our study: How are the three areas of the CRMT (knowledge and identity, rigor and support, and power and participation) reflected in the planning and enactment of a community based mathematical modeling lesson? Children connected to an authentic situation that impacted their own community, they investigated possible inequities, and mathematized fairness which deepened their critical mathematical agency. The case study demonstrates how teachers can design lessons that help children make sense of complex social topics and advance their mathematical reasoning strategies. Our case study contributes new insights related to teacher decision-making and classroom practice to the limited research on mathematical modeling with young children and the lack of community-based modeling lessons at this grade level.

4:15 PM - 5:15 PM

#702 - Research Paper - LA Convention Center - Room 512

Mending the bridge to Equitable mathematics instruction through technology

Peter Eley, Fayetteville State University

Access and opportunity are constant issues that educators must contend with in supporting students that reside in the margins. Access to rigorous mathematics content, quality math instruction, and engagement opportunities are often limited in rural communities. Mass projects were initiated to address broadband internet access as a result of the global Covid-19 pandemic (Wheeler, 2021). Broadband allowed these communities the opportunity to utilize technology and access information in ways they were never able to do before. The increase in access provided more opportunities for mathematics teachers to engage more mathematics students. Schools across the nation gained increased access to technology because of legislation that provided funds to districts to purchase these technologies (US Department of Education, 2021).

4:15 PM - 5:15 PM

#702 - Research Paper - LA Convention Center - Room 512

Understanding the Implementation and Impacts of a Web-Based Math Feedback Tool During COVID

Kirk Walters, WestEd

Rachel Garrett, American Institutes for Research

Dioni Garcia-Piriz, American Institutes for Research

Eben Witherspoon, American Institutes for Research

Max Pardo, American Institutes for Research

This paper presents the implementation and impact results of a multi-site, clustered randomized trial of ASSISTments, a web-based math feedback and formative assessment tool for students and teachers. The study involves a national sample of 54 schools and more than 4,700 students from geographically and culturally diverse settings, building from a prior efficacy study of the tool conducted in rural Maine. Data collection spanned the 2018-19 through 2020-21 school years, providing the unique opportunity to study the effects of the program during the historic disruptions caused by the COVID-19 pandemic. Implementation data include teachers' usage of the tool and teachers' participation in professional development, including virtual coaching sessions. Student outcome data include attitudes towards math and math performance. Exploratory analyses examine the relationships between teacher professional development and level of teaching experience and implementation fidelity. Findings are relevant to researchers and policymakers interested in understanding the implementation and effectiveness of technology-enabled supplemental math programs as used in fully online, hybrid, and in-person instructional settings.

4:15 PM - 5:15 PM

#703 - Research Paper - LA Convention Center - Room 513

A Microgenetic Approach to Novice Teachers' Learning Through Teaching

Sebnem Atabas, University of Southern California

Yasemin Copur-Gencturk, University of Southern California

Our current understanding of learning through teaching (LTT) is informed by a scant number of studies with limitations in attributing learning to teaching only. In this study, we conduct a systematic investigation by adopting microgenetic approach (Siegler, 1995). Specifically, we examine what content-specific knowledge novice mathematics teachers draw on while teaching—planning, implementation, and reflection. We closely followed five novice teachers throughout three data collection cycles. Each cycle is comprised of a 2-day lesson plan, pre-interview, and post-interviews after each day of teaching. In our analysis, we identified segments showing evidence of knowledge, coded each segment with a knowledge code, and organized our coding chronologically. Results showed that one teacher, Mike, had a consistent increase in the frequency of general pedagogical knowledge whereas two teachers, Linda and Hana, showed an increase in the frequency of knowledge of students' mathematical thinking and synthesized PCK (i.e., connected knowledge of students' understanding of a particular concept and teaching that concept). These findings show evidence that teachers learn through teaching but with a significant variance among them depending on the cognitive demand of tasks, the depth of their content knowledge, and who they position to be the problem-solver in class (students or the teacher).

#703 - Research Paper - LA Convention Center - Room 513

Math Attitudes and Identity of High Schoolers Impacted Through Participating in Informal, Near-peer Mentoring - Not Able to Present

Aaron Wilson, University of Texas Rio Grande Valley

Sergey Grigorian, University of Texas Rio Grande Valley

Mayra Ortiz, University of Texas Rio Grande Valley

Xiaohui Wang, University of Texas Rio Grande Valley

Eliazar Patiño, University of Texas Rio Grande Valley

John Knight, University of Texas Rio Grande Valley

Research in mentoring has shown that students may at times be more willing and able to absorb information that is delivered to them by their near-peers, rather than by traditional figures of authority, like teachers and professors. In this study, underrepresented minority high school students participated an informal learning experience that was led by college students who were "near-peers" to the high schoolers. Student were engaged by interactive MathShows, following a Math Social Media Campaign, and attending a summer Math Internship. The mixed methods study addresses impacts of the experiential learning intervention on high schoolers with respect to attitudes toward mathematics, identity alignment, and also concerning interactions with the college near-peers. Results of this study address the goal of broadening participation of underrepresented student groups in STEM careers.

4:15 PM - 5:15 PM

#704 - Research Paper - LA Convention Center - Room 514

Developing Meanings for Graphs from Number Lines: The Case of Zane

Halil Tasova, California State University San Bernardino

In this study, I report on developmental shifts of a middle school student's (Zane) graphing activity as I implement an instructional sequence that emphasizes quantitative and covariational reasoning. Results suggest that representing quantities' magnitudes as varying length of directed bars on two parallel lines, forming a new space by making those lines orthogonal, and generating a point by joining those bars were an integral part of Zane developing productive meanings for graphing quantities in the Cartesian plane.

#704 - Research Paper - LA Convention Center - Room 514

Mathematics teachers' enactment of research-based instructional practices

Michele Carney, Boise State University
Angela Crawford, Boise State University
Megan Schmidt, Boise State University
Joe Champion, Boise State University

This research is set in the context of a large-scale project focused on improving grades 6-8 students' mathematics achievement through effective sequencing of research-based instructional practices. We analyzed the reflections of 77 teachers engaged in a 2-3 week teaching study to better understand how teachers - with varying instructional beliefs - interpret and enact these practices. We found teachers of varying beliefs tended to experience the same type of issues and success when implementing the practices. However, teachers who held more traditional instructional beliefs tended to experience the issues with higher frequency. Our results have implications for instructional reform efforts, suggesting a need for differentiated support structures for teachers with more traditional instructional beliefs.

4:15 PM - 5:15 PM

#705 - Interactive - LA Convention Center - Room 515A

In the shadow of the shadows: A critical re-examination of attempts to increase equity in mathematics achievement

Randy Olson, San Bernardino City USD

The technical aspects of how to effectively teach mathematics is important, but it is only one aspect of a much larger picture of how to improve mathematics achievement and, ultimately, how to close the achievement gap. While many articles have been written about increasing achievement and providing equity, they seem to be based on several unchecked assumptions which may undermine attempts to accomplish either goal. Since values and beliefs guide action and practice, it is important that teacher educators re-examine their own values and beliefs so they can best equip future and practicing mathematics teachers to have an impact on not only achievement, but equity.

September 29 - 9:45 AM - 11 AM

#801 - Interactive - LA Convention Center - Room 153 BC - **Not Able to Present**

Marriage of Mathematics Education and Special Education: Supporting Students Who Struggle in Mathematics

Barbara Dougherty, University of Hawaii
Karen Karp, Johns Hopkins University
Russell Gersten, IRG

In the wake of the COVID-19 pandemic, the achievement gap between high-performing and low-performing has surpassed historical levels. This is a call to action for strong collaborations between the fields of mathematics education and special education. Thus, this session provides opportunities for researchers in mathematics education and special education to come together to 1) identify those interested in supporting students who have difficulties in mathematics; 2) brainstorm potential research areas and associated research questions; and 3) determine ways to implement high priority research studies in a collaborative way that honors the integrity of each discipline.

1:00 PM - 2:15 PM

#802 - Interactive - LA Convention Center - Room 153 BC

Engaging Teachers and Coaches in Using Learning Trajectory-based Curricular Resources for Asset-Based Instruction

Jennifer Suh, George Mason University
Theresa Wills, George Mason University
Sara Kirschner, George Mason University
Maureen Vora, George Mason University

Although many research papers and books have been written around learning trajectories, they have not always been translated in usable ways for teachers and coaches. This interactive session has been designed to engage the research community as well as the school community, including teachers, coaches and administrators in using learning trajectories for instructional purposes to see the strength in students and build on their mathematics proficiencies. How can researchers and mathematics teachers and coaches collaborate on making LT research more usable in teaching, assessing and developing curricular resources to strengthen student learning?

We will share how teachers and coaches used instructional learning trajectories to analyze and support student learning during the Pandemic using an asset-based approach. In addition, practitioners can use the design of the PD to engage others in learning trajectory research to create the LT aligned curricular resources.

This session is designed to Link Research to Practice by strengthening research-based practices in using learning trajectories in instruction and assessment to improve the learning conditions for diverse mathematics learners that teachers work with to access rigorous mathematics.

2:45 PM - 4:00 PM

#803 - Interactive - LA Convention Center - Room 153 BC

Utilizing the Plan, Do, Study, Act (PDSA) Cycle to Revise Protocols for Identifying Equity-Based Mathematical Teaching Practices and Standards for Mathematical Practices with a Lens of Equity

Basil Conway, Columbus State University

Katherine Hammonds, Columbus State University

This session describes Columbus State University's transition from a rubric-based observation tool to a noticing indicator tool focused on NCTM's (2014) Mathematics Teaching Practices and the Standards for Mathematical Practices as identified by the Common Core State Standards (NGA, 2010) using a lens of equity (Aguirre, Mayfield-Ingram, and Martin, 2013). The case study exemplifies the PDSA cycle in the Network Improvement Community (NIC) model as part of the Mathematics Teacher Education Partnership. Participants will learn about the noticing indicator tool and its systematic use as part of CSU's teacher preparation program and use it to debrief a video from NCTM's Principles to Action Toolkit. Session attendees will collaboratively participate in a PDSA cycle by utilizing current field data, reflecting on the current noticing indicator tool, and brainstorming potential next steps for implementation of the noticing indicator tool aimed to improve the practice of teacher educators and future teachers.