

10 AM ET

Session: #11 - Research Paper

"I need to measure the base and the height": Examining Preservice Teacher's Responses to Area Conservation Tasks

Dae Hong, University of Iowa

Abstract

The purpose of this work was to explore how elementary preservice teachers responded to area conservation tasks. We administered written pre-assessments, followed by semi-structured interviews with 23 preservice teachers, asking them to respond to and reason with area conservation tasks. Findings highlighted several interesting preservice teachers' challenges when assessing area conservation tasks. In many cases, preservice teachers exhibited struggles similar to students, especially with regards to the justification of their area conservation claims and they have concept images of different shapes that do not coincide with the corresponding mathematical definitions.

Contributors

Dae Hong, University of Iowa

Cristina Runnalls, California State Polytechnic University, Pomona

10 AM ET

Session: #11 - Research Paper

Exploring PSTS' Responses to Students' Volume Misconceptions

Dae Hong, University of Iowa

Abstract

The purpose of this study was to explore how elementary pre-service teachers responded to students' hypothetical misconceptions about volume measurement. We carried out both pre-assessments and follow-up interviews with 17 pre-service teachers, with tasks focused on both volume content knowledge and hypothetical student responses to volume tasks. Preliminary findings indicated a preference towards show-and-tell responses, often with a focus correct or incorrect use of the volume formula. While PSTs were frequently able to correctly identify students' learning challenges with regards to volume, they experienced difficulty in addressing those challenges in meaningful ways. Recommendations for supporting pre-service teachers in teacher education programs are discussed.

Contributors

Dae Hong, University of Iowa

Cristina Runnalls, California State Polytechnic University, Pomona

10 AM ET

Session: #11 - Research Paper

Student Gesture & Diagram Use as Assessment Data for Units Understanding

Cathy Kaduk, North Central College

Abstract

Gesture and diagram-use observations can play a role in triangulating evidence when making short-term decisions about students' thinking. Results of an analysis of fourth-grade students solving array multiplication problems provide data for making inferences about student number construction (units understanding) and related inferences about additive vs multiplicative reasoning by using gestures, verbal thinking, diagram-use, and other written work. Array multiplication problems are common in third – sixth grade. Break-apart multiplication examples in the study represent the distributive property. The analysis of video and written work from 64 protocol interviews of students' gestures, explanations, and written work using a coding system based on prior unit coordination studies led to the development of a teacher observational tool for this purpose. Training teachers and teacher candidates to observe gestures and diagram use is underway.

Contributors

Cathy Kaduk, North Central College

10 AM ET

Session: #12 - Research Paper

Formatively Assessing ELs in Mathematics with an Instructional Protocol

Richard Kitchen, University of Wyoming

Abstract

We describe an instructional intervention designed to help teachers engage English learner (EL) students in mathematical problem solving and reasoning through discourse. The "Discursive Assessment Protocol" (DAP) integrates Pólya's problem solving framework with research-based instructional strategies that benefit ELs. An instructional vignette is provided that demonstrates how the DAP can function as a formative assessment tool to support the development of EL students' mathematical registers.

Contributors

Richard Kitchen, University of Wyoming

Libni B. Castellón, University of Wyoming

Karla Matute, University of Wyoming

10 AM ET

Session: #12 - Research Paper

Culturally Responsive Elementary Mathematics Teaching: A Multi-Case Study

Casedy Thomas, The University of Alabama

Abstract

This multi-case study examines how three elementary teachers, who have all been certified in culturally responsive teaching (CRT) through professional development opportunities by their district, enact mathematics teaching practices that support CRT. Further, the study focuses on the district structures that seem to mediate the development and implementation of CRT with elementary students in mathematics. The findings focus upon central tenets of CRT demonstrated across the three cases.

Contributors

Casedy Thomas, The University of Alabama

10 AM ET

Session: #12 - Research Paper

Latine family math: co-designing and co-constructing a math activity

Susie Beltran Grimm, Purdue University

Abstract

Mathematics achievement at school entry is the strongest predictor for eighth-grade performance, regardless of race, gender, or family socioeconomic status (Duncan et al., 2007). California Latine children continue to lack math proficiency. Existing literature has demonstrated that Family Engagement supports children's development. However, Latine parents often feel less comfortable doing math themselves and participating in their children's math learning. This study was designed to uncover participants' cultural repertoires and learning experiences to explore how Latine families perceived and engaged in co-design workshops to develop a mathematics activity for their 3-5 years old children. This study collected data from semi-structured interviews and co-design workshops (including co-design workshop recordings, transcriptions, photos, and screenshots). In centering Latina mothers as designers and users of their own mathematics learning experience, it positioned them as experts in their own and their children's learning and allowed for the co-design and co-creation of a meaningful learning math experience.

Contributors

Susie Beltran Grimm, Purdue University

10 AM ET

Session: #13 - Research Paper

What Foundational Skills Matter for Algebra I Success?

Mary Klute, SRI International

Douglas Van Dine, Marzano Research

Abstract

To increase opportunities for students to take advanced math courses in high school, there has been a trend toward enrolling students in Algebra I in the middle grades (Star et al., 2015). However, if students are accelerated into Algebra I during middle school, they may miss the opportunities to develop the foundational skills required for success in advanced math (Domina, McEachin, Penner, & Penner, 2015). Educators face the challenge of determining which students are ready to take Algebra I in middle school and which students are not. To inform strategies to address this challenge, this study examined whether student knowledge in five domains of math assessed in grade 7 was associated with Algebra I achievement.

Contributors

Mary Klute, Marzano Research

Douglas Van Dine, Marzano Research

Barbara Dougherty, College of Education, University of Hawai'i at Mānoa

10 AM ET

Session: #13 - Research Paper

Student-Teacher Ratio Impact on Algebra I Achievement

Macie Baucum, Texas A&M University - College Station

Abstract

The purpose for this paper is to investigate factors that influence the relationship between student-teacher ratio (STR) and Algebra I achievement and other district-level factors.

Researchers analyzed the effects of class size on students' mathematics achievement while controlling for the moderating effects of student demographic and district-level variables. This nonexperimental correlational study was used to examine students' mathematics achievement in public and charter school districts (N =1100) in Texas through a multiple OLS regression analysis. Student-teacher ratio exerted a statistically significant effect on students' mathematics achievement when controlling for other student- and district-level factors. In addition to class size, the percent of economically disadvantaged students, community type, and percent expenditure on instruction produce the strongest effects on Algebra I achievement. These findings can aide district officials and policy makers in making decisions about expenditure, class size, and employment on the district and school level.

Contributors

Macie Baucum, Texas A&M University - College Station

Aamir Fidai, Texas A&M University - College Station

Robert Capraro, Texas A&M University - College Station

10 AM ET

Session: #13 - Research Paper

Managing students' non-canonical approaches to solving equations: Linguistic resources teachers use to respond to students' mathematical work

Amanda Brown, University of Michigan

Sharon Strickland, Texas State University

Orly Buchbinder, University of New Hampshire

Dan Chazan, University of Maryland

Patricio Herbst, University of Michigan

Abstract

A historical review of mathematics curriculum suggests a long-standing canonical method to solving equations that teachers often see as “the” way to solve equations. In this paper, we examine data collected from a nationally-distributed sample of 524 secondary mathematics teachers who responded to a set of scenario-based survey items that represent the instructional situation of solving equations. The items featured scenarios in which students presented non-canonical solution methods and asked participants to share how they would respond to that situation. Using a framework that draws on systemic functional linguistics, we describe patterns in the various linguistic resources teachers use to manage the situation. While closed moves are frequently used to avoid discussion of non-canonical methods, our results suggest that teachers find ways to make regular use of: (1) closed moves when accommodating students' non-canonical solution methods and (2) open moves when steering the conversation back to the canonical solution method.

Contributors

Amanda Brown, University of Michigan

Sharon Strickland, Texas State University

Orly Buchbinder, University of New Hampshire

Dan Chazan, University of Maryland

Patricio Herbst, University of Michigan

10 AM ET

Session: #14 - Research Paper

Confronting Pedagogical Inequities in Math Classrooms with Case-Based Instruction

Alesia Moldavan, Fordham University

Monica Gonzalez, East Carolina University

Abstract

Recent reform in teacher education looks to encourage preservice teachers to engage in authentic classroom situations that explore equity-based practices by connecting theory and practice (AMTE, 2017; NCTM, 2000, 2014). This study reports on mathematics teacher educators using case-based instruction to engage preservice teachers in conversations about pedagogical inequities and disparities by analyzing the impact of implicit biases and policies that reaffirm systems of oppression in mathematics education. By examining cases as a collective group from an outsider's perspective, the preservice teachers were able to critique the teachers in each case for their assumptions and make visible the influences of such assumptions shaping their actions. Recommendations are shared for using similar case-based instruction to equip preservice teachers with the knowledge and skills needed to embed equity-based practices for purposes of strengthening professional practice and challenging unjust beliefs that sustain educational inequities.

Contributors

Alesia Moldavan, Fordham University

Monica Gonzalez, East Carolina University

10 AM ET

Session: #14 - Research Paper

Using Case Studies to Assess Pre-Service Teachers' use of Visual Representations to Solve Mathematics Problems

Amy Scheuermann, MNSU, Manakto

Abstract

In this article, we present findings from a study that examined shifts in special education pre-service teachers' knowledge and applied instructional practices about visual representations (VRs) in mathematics for students with disabilities (SWDs). Using a case study approach, data was collected from 25 pre-service special education teachers before and after instruction. The data revealed increases in both knowledge about (definitions, roles, how to use VRs in instruction, type of instruction) and application of VRs for SWDs. Despite the positive shifts, challenges within the mathematics content remained. Implications for pre-service teacher preparation and research are provided.

Contributors

Amy Scheuermann, MNSU, Manakto

Delinda van Garderen, University of Missouri - Columbia

Stephanie Hopkins, University of Missouri

Stacy Hirt, University of Missouri-Columbia

10 AM ET

Session: #14 - Research Paper

Connecting Preservice and Inservice Teacher Learning: Communities of practice

Damon Bahr, Brigham Young University

Abstract

The presenter joined with the principal and faculty of an elementary school to create a program that would synthesise preservice and inservice teacher education. The program's goal was to enhance the mathematics teaching of the faculty while also enriching preservice teachers' (PSTs) clinical work at their school. Creating and implementing the program fostered some rather interesting dynamics amongst groups of ISTs and PSTs as they worked together to connect theories underlying reform-based mathematics teaching with the in-class practice of such. In the study presented here, the experience of the ISTs in this potentially synergistic program was investigated using a Communities of Practice (Wenger, 1998) lens. Significant changes in both IST teaching and mentoring practice resulted when they accepted the presenter's invitation to assume new identities as co-mathematics teacher educators.

Contributors

Damon Bahr, Brigham Young University

10 AM ET

Session: #15 - Research Paper

Mathematics Textbooks Content Development at the Primary Stage: A Proposed Vision

Ibrahim Khalil, UNIVERSITY OF BISHA

Mohamed Alnatheer, king Saud University

Abstract

The paper presents a proposed vision to develop mathematics textbooks content for the primary stage. It offered a framework to organize the content of the mathematics textbooks and indicated the content of each part of the framework. Furthermore, it explained ways of including various theories in the textbooks content, and showed how the developed content facilitates the tests of Trends in International Mathematics and Science Study (TIMSS).

Keywords: proposed vision, primary stage, textbook, mathematics.

Contributors

Ibrahim Khalil, UNIVERSITY OF BISHA

Mohamed Alnatheer, king Saud University

10 AM ET

Session: #15 - Research Paper

How Elementary School Teachers Tackle Fraction Word Problems: A Study of Teachers' Strategies and Errors

Yasemin Copur_Gencturk, University of Southern California

Abstract

Understanding how teachers deal with word problems not only would provide insights into teachers' thinking, but also would reflect what learning opportunities teachers provide to their students. The present work sought to advance the existing literature by examining how 350 fourth- and fifth-grade teachers in the United States implemented strategies to solve four multistep fraction word problems. The findings indicated that the most common error blocking teachers from solving the multistep word problems was their failure to devise a solution strategy. We also found that a statistically higher percentage of teachers who solved all the problems correctly used algebraic notations or pictorial representations compared with those who answered at least one question incorrectly.

Contributors

Yasemin Copur_Gencturk, University of Southern California

11:30 AM ET

Session: #21 - Interactive Session

An Explorative Study on the Implementation of Go Game in Third-Grade Mathematics Classrooms

Xiuwen Wu, National Louis University

Xiuwen Wu, National Louis University

Xinming Guo, Go and Math Academy

Abstract

This research investigates the affordances of the strategy board game, Go, in elementary classrooms. It addresses three questions: 1) What natural opportunities for learning and using mathematics arise from playing Go? 2) How are Go and supporting materials helpful for all learners in meeting the state mathematics learning standards? 3) What are teachers' and students' perceptions of Go? To reveal naturally-occurring Go and math connections, this research employed primarily the following data: teacher and student surveys, teacher interviews, and video recordings of Go lessons and games. The results provided strong support for incorporating Go in the mathematics classroom. The participating teachers perceived a strong math-Go game connection and observed multiple mathematical skills their students utilized and practiced during Go games, pertaining to number sense, number operations, and visual/spatial thinking. Go game created for all learners a game-based, low-anxiety space for them to apply and practice their mathematical skills and concepts.

Contributors

11:30 AM ET

Session: #22 - Research Paper

Improving Student Understanding of Symbolic Numerical Magnitude

Delinda van Garderen, University of Missouri - Columbia

Abstract

In our study we examined changes in student justifications over time with an intervention that drew from the best instructional practices in the fields of special education and mathematics education. These justifications were provided by teacher-identified struggling second-grade students while engaging in symbolic numerical magnitude comparisons. Following screening, we conducted 8 instructional sessions to promote conceptual understanding of fundamental ideas for numerical magnitude. Using data collected from 71 instructional tasks, we analyzed the types of justifications students provided and how these justifications changed over time. Prior to the intervention, most student justifications involved few components of a valid mathematical justification. Over the course of the study, students provided more valid and generalizable mathematical justifications.

Contributors

Delinda van Garderen, University of Missouri - Columbia

John Lannin, University of Missouri - Columbia

11:30 AM ET

Session: #22 - Research Paper

Building a Mathematics Education Evidence Base: Fraction Intervention

Jessica Hunt, North Carolina State University

Abstract

One challenge facing the fields of mathematics education and special education is how to design instruction on fraction concepts that can meet the needs of diverse learners. An innovation that shows promise is to base instructional design upon well-established trajectories of students' fraction learning. However, little research has been done to establish the effectiveness of this approach. We report the results of an exploratory study from an intervention developed using a validated trajectory of students' fraction concepts. Mixed methods analyses were conducted on students' problem-solving actions across instructional sessions as well as their performance on a standards aligned measure of fractional knowledge before and after instruction. Results suggest increases in both conceptual understanding and performance for nine students. We discuss the findings in relation to practice from the fields of mathematics education and special education and point to areas for future research.

Contributors

Jessica Hunt, North Carolina State University

Kristi Martin, Sam Houston University

Alejandra Duarte, North Car

11:30 AM ET

Session: #22 - Research Paper

Fifth Grade Students' Conceptions of Number Lines: The Meaning of Tick Marks

Rebecca Borowski, Western Washington University

Abstract

This paper discusses findings from a teaching experiment which investigated ways 5th grade students represented quantities on number lines and how students' construction of linear units influenced their construction of and reasoning about number lines. Of particular note was students' meanings of tick marks. Two students frequently numbered tick marks in such a way that they counted the unit that came after the tick, rather than the unit that came before the tick, as is the convention. One student coordinated ticks and units in a way that was consistent and generalizable but primarily numeric. One student constructed meanings of tick marks as proxies that could stand in as representations of the preceding unit. Implications of these findings are also discussed.

Contributors

Rebecca Borowski, Western Washington University

11:30 AM ET

Session: #23 - Research Paper

Noticing student ideas in writing: How do students articulate the effects of scale factor?

James Bywater, James Madison University

Sarah Lilly, University of Virginia

Jennifer Chiu, University of Virginia

Abstract

Written student mathematical explanations provide teachers with opportunities to notice how students understand mathematical ideas. However, students are rarely given opportunities to write about their mathematical understanding and few studies have examined contexts where students are engaged in written mathematical discourse. The participants in this study were 68 high school geometry students. The students' written explanations about how scale factor affects a rectangular prism were examined for how they articulated the variables of scale factor, dimensions, volume, and surface area and the relationships between these variables. Results detail the spectrum of student understandings that were elicited. The significance of these results for supporting students to articulate their understanding of variables and their relationships are discussed.

Contributors

James Bywater, James Madison University

Sarah Lilly, University of Virginia

Jennifer Chiu, University of Virginia

11:30 AM ET

Session: #23 - Research Paper

Coordinating Co-Occurrence and Same Extent When Modeling Proportions

Andrew Izsak, Tufts University

Abstract

We designed tasks that encourage reasoning about proportional relationships between two co-varying quantities from the novel variable-parts perspective. We then investigated how 10 future middle grades mathematics teachers generated equations to relate quantities in the task situations. Our analysis revealed the importance of coordinating two perspectives on equations as models of problem situations which we term the co-occurrence and same extent perspectives. We argue that past research on school algebra has overlooked as important the distinction between the two perspectives. We then present results demonstrating that ways in which the future teachers did or did not coordinate the two perspectives played a consequential role in their generating normatively correct and normatively incorrect drawings and equations.

Contributors

Andrew Izsak, Tufts University

Sybilla Beckmann, University of Georgia

11:30 AM ET

Session: #23 - Research Paper

Analyzing Student Use of Number Sense Strategies

Patrick Kirkland, University of Notre Dame

Abstract

What is "number sense"? How do we gather evidence that a student has strong "number sense"? Is it possible to assess a student's number sense in any systematic way? What do students' chosen strategies tell us about their current number sense? We will share the findings from a think-aloud protocol conducted with middle and high school students while the students solved non-traditional problems designed to measure their number sense. Results from the analysis of students' strategy use will be discussed.

Contributors

Patrick Kirkland, University of Notre Dame

11:30 AM ET

Session: #24 - Research Paper

Research, Researchers, and the Mathematics Classroom: What Relationships? What Impacts?

Silvanio De Andrade, UEPB

Abstract

I present a discussion about the relationship between mathematics education research and the classroom and their impacts. I show something about the conditions of doing, knowing and being of relationship between research and classroom and theirs impacts. What do research and the researchers have to say to the mathematics classroom and what has this one shown them? How could research and researchers more effectively contribute to the change in the classroom?

Contributors

Silvanio De Andrade, UEPB

11:30 AM ET

Session: #24 - Research Paper

Developing Mathematics Teachers' Cultural Awareness Through Education Abroad

Blair Izard, University of Northern Iowa

Abstract

As there has been significant attention from professional organizations to address issues of access and equity within mathematics education, there has been an emphasis on creating mathematics classrooms that are responsive to students' backgrounds, experiences, and cultural perspectives. In order to best meet these needs, we must prepare teachers to have a deep understanding of their own culture, their students' cultures, and how these identities influence the classroom.

The purpose of this study was to describe and interpret a preservice mathematics teacher's cultural development during a semester-long mathematics-focused education abroad program. Findings suggest that education abroad can advance mathematics teachers' cultural awareness and capacity to work across cultures. Implications for mathematics teacher education include strategic development of such content-focused programs and application of specific elements of these programs (i.e., explicit discussions and reflections about culture) within a US-based setting.

Contributors

Blair Izard, University of Northern Iowa

11:30 AM ET

Session: #24 - Research Paper

Math Course-taking and Postsecondary Outcomes: Results from a national survey

Burhan Ogut, American Institutes for Research

Abstract

High school course-taking has been a significant topic in education reform policy because it has the potential to increase equity in academic achievement, college enrollment, and future success for students. This study provides a current and comprehensive description of the relationship between math course-taking and postsecondary outcomes using recent data from a nationally representative study, the high school longitudinal study (HLS:09). The results show that math course-taking is related to students' postsecondary outcomes including college enrollments, selectivity of enrolled colleges, majoring in STEM, and persistence. The results from course-taking patterns and decision tree analyses point to the importance of Precalculus and AP Calculus in college enrollment, as well as in improving outcomes specifically for disadvantaged students.

Contributors

Burhan Ogut, American Institutes for Research

Ruhan Circi, American Institutes for Research

Nevin Dizdari, American Institutes for Research

Charles Scott, American Institutes for Research

11:30 AM ET

Session: #25 - Research Paper

Balancing Tensions between Research Fidelity and Math Instructional Improvement at Scale

Craig De Voto, University of Illinois at Chicago

Benjamin Superfine, University of Illinois at Chicago

Alison Castro Superfine, University of Illinois at Chicago

Abstract

This paper reports findings from the first year of the CASPIR Math Project, a National Science Foundation-funded, design-based implementation research project focused on enhancing the individual capacities of math teachers, and organizational capacities of schools and districts to support them. One primary issue that has emerged during CASPIR's first year is the tension between the goals of (a) providing coherent organizational and instructional improvement across all levels of school districts in ways that are grounded in research, and (b) adapting the PD model to varied and changing district contexts and conditions. We analyze the infrastructure developed and employed by CASPIR to mitigate this tension between fidelity to the research base on math improvement and adaptability to unique district contexts.

Contributors

Craig De Voto, University of Illinois at Chicago

Benjamin Superfine, University of Illinois at Chicago

Alison Castro Superfine, University of Illinois at Chicago

11:30 AM ET

Session: #25 - Research Paper

Evaluating the Efficacy of a Learning Trajectories for Early Mathematics

Douglas Clements, University of Denver

Abstract

Although basing instruction on learning trajectories (LTs) is recommended, there is little direct evidence regarding the premise of a LT approach. We report on scientific tests not heretofore conducted on the LT construct: eight experiments that were rigorous in two ways. First, they are Randomized Trials allowing causal interpretations. Second, the control group received an intervention that is as similar as possible to the LT intervention, except for a single defining attribute of the LT construct. Does instruction:

in which LT levels are taught consecutively (for children at level n , $n + 1$, then $n + 2$) result in greater learning than instruction that solely targets level $n + 2$? aligned with an LT's sequence result in greater learning than a traditional curriculum's activities and sequence or uses the same activities as those of the LT but chosen/ordered by 'thematically-based projects'?

Contributors

Douglas Clements, University of Denver

Julie Sarama, University of Denver

Arthur Baroody, University Of Illinois At Urbana-Champaign

11:30 AM ET

Session: #25 - Research Paper

Validity Study of the Numerically Leveled Performance Assessment Framework

Eula Monroe, Brigham Young University (Emerita)

Abstract

We present evidences of validity regarding theoretical rationales for the Numerically Leveled Performance Assessment Framework (NLPAF), a researcher-developed, classroom-tested framework for supporting elementary teachers in designing and implementing mathematics performance assessments. The theoretical rationales are manifest in the NLPAF elements, situated in related literature at the time of framework design. The NLPAF has since been used by 16 cohorts (≈ 400 teachers) enrolled in a 2-year (18-semester-hour) professional development program in reform mathematics education directed by the researchers. In anticipation of our continued NLPAF use and in preparation for possible wider dissemination, we reexamined the NLPAF elements within the context of current educational measurement and mathematics education literature. This qualitative examination yielded data upon which validity assumptions and inferences reported in the current study were made. A quantitative study of student scores obtained from teacher-designed, NLPAF-based performance assessments is in progress, with additional validity evidence anticipated regarding score interpretations and uses.

Contributors

Eula Monroe, Brigham Young University (Emerita)

Damon Bahr, Brigham Young University

1 PM ET

Session: #31 - Posters

Exploring Mathematical Concepts through Quilt Design: An Instructional Intervention

Clare Bell, University of Missouri-Kansas City

Clare Bell, University of Missouri-Kansas City

Abstract

Through the Quilt Design project, under-performing fifth-grade students engaged in an apprenticeship-like context to develop understanding of mathematical concepts commonly used in quilt making. Analysis of project data highlighted benefits of design-based learning:

- a) students expressed excitement about designing and constructing quilt blocks with authentic quilting materials,
- b) students were supported to construct knowledge rather than receiving instructions for how to provide answers to questions,
- c) as students progressed through the project, their mathematical comments became more detailed and reflected their own mathematical thinking.

This study tells the story of a culturally responsive, design-based approach to instructional intervention. Data suggest that under-served student populations benefit from design-based learning experiences that are based on their background experiences, interests, and needs.

Contributors

1 PM ET

Session: #31 - Posters

Creative Insubordination and Appropriation of Tools for Teaching Elementary Math

Nii Tackie, University of Louisiana at Lafayette

Nii Tackie, University of Louisiana at Lafayette

Abstract

Field experience is considered one of the important components in preparing preservice teachers (PSTs) for teaching. In this study, the author investigated how elementary PSTs utilized creative insubordination and appropriation of pedagogical tools to support students' mathematics learning. A multiple case study design was used to analyze PSTs tutoring reports and interview transcripts. Findings revealed that PSTs who effectively utilized creative insubordination made decisions that supported students' mathematics learning. On the other hand, PSTs who failed to apply creative insubordination to make productive teaching and learning decisions failed to provide meaningful mathematics support to their students. Implications for these findings will be discussed in the presentation.

Contributors

1 PM ET

Session: #31 - Posters

Mathematical Perceptions of Self Among First-time College Freshmen

Katrina Rothrock, University of Wisconsin-Eau Claire

Katrina Rothrock, University of Wisconsin-Eau Claire

Abstract

This study investigated the relationship of first-time college freshmen's mathematics course enrollment, gender, and high school mathematics course experience to their mathematical mindset, identity, self-efficacy, and use of self-regulated learning strategies in mathematics courses. Two forms of a researcher-developed survey instrument were administered to students enrolled in three different mathematics courses at a Midwestern public research university to examine the differences among those constructs at the beginning and end of the Fall 2018 semester. Multivariate analyses of variance on the data indicated significant differences in students' mathematical identity and self-efficacy scores at the beginning of the semester (299 participants), and in students' mathematical identity scores at the end of the semester (176 participants) across all three college courses. Mathematical self-efficacy scores for all subgroups decreased over the course of the semester for participants who took both surveys (68 participants). No statistically significant differences were identified with regard to gender.

Contributors

Susan Gay, University of Kansas

1 PM ET

Session: #31 - Posters

A Proposed Model to Teach Mathematical Knowledge in the Primary Stage

Ibrahim Khalil, UNIVERSITY OF BISHA

Ibrahim Khalil, UNIVERSITY OF BISHA

Abstract

The proposed model introduces procedural and conceptual mathematical knowledge through the mathematical power processes standards (communicating, connecting, and reasoning), and leads to mathematical knowledge deep understanding to enables students from solving mathematical problems. The model relies on several principles such as, gradual introduction of the mathematical concept, allow students to present and express their ideas, allow students to think, introduce students to actual life problems, encourage students to recall ideas concepts and previous skills related to the new lesson presented, use manipulatives in introducing the mathematical concept, consider students differences when presenting tasks and activities, encourage students to employ mathematical knowledge in solving life situations and problems, establish a balance in introducing procedural and conceptual knowledge, encourage students to infer correlations between concepts and procedures, correlate previous information and concepts with new ones.

Contributors

1 PM ET

Session: #31 - Posters

Employing the flipped classroom strategy in primary mathematics classes

Ibrahim Khalil, ministry of education

Ibrahim Khalil, ministry of education

Abstract

This study aims to identify the implications of using the flipped classroom strategy in primary schools in teaching math. This study used a qualitative approach. The sample of the study consists of (2) math teachers in a primary school and (42) students from the sixth grade. The study used the following tools: teacher's planner, participant observation card, and interviews. The study used thematic analysis to analyze the data. Results included that the flipped classroom strategy contributed to the development of mathematical achievement, classroom interaction, the attitude towards teaching and learning math. The flipped classroom strategy allowed teachers to take more of lesson ideas, use several strategies in the classroom, plan and prepare for the lesson. The study recommends teachers to employ the strategy in math education, and to produce instructional videos for math lessons.

Keywords: flipped classroom; Mathematics; Strategy; and Primary Stage.

Contributors

1 PM ET

Session: #31 - Posters

Teacher Usage of Performance Data from Open Educational Resources Predicts Student Achievement

Hannah Hausman, University of California, Santa Cruz

Hannah Hausman, University of California, Santa Cruz

Abstract

Open educational resources (OERs) are being increasingly incorporated into K-12 education and emerging research has revealed a positive association between students' usage of OERs and achievement. However, little research has examined how teachers' usage of OERs affects student achievement. The present study began to fill this gap in the literature in the context of Algebra Nation (AN), an online learning platform focused on Algebra I. Teachers primarily self-reported using Algebra Nation to support student learning at home, assigning videos and problems as homework. However, multiple linear regressions revealed no association between teachers' self-reported usage and students' assessment scores. In contrast, the objective log usage data revealed that the more frequently teachers downloaded reports of students' performance on practice tests, the better students performed on the EOC assessment. Thus, OERs and other digital learning platforms should incorporate and evaluate dashboards for teachers to track students' learning progress.

Contributors

Thomasenia Lott Adams, University of Florida

Walter Leite, University of Florida

1 PM ET

Session: #31 - Posters

Heuristics from teachers for game-based math learning design and implementation

Chih-Pu Dai, Florida State university

Chih-Pu Dai, Florida State university

Abstract

Teachers' perceptions governing the design and development of the learning environments are critical for the successful implementation in the classroom. However, there are associated challenges. In this paper, we proposed a set of heuristics to inform game-based math learning design and implementation in the classrooms. Adopting the concepts of action-reflection-critique from the Envisionment and Discovery Collaboratory (EDC) model as the lens, design and implementation of game-based math learning are the two major themes of our qualitative findings from teacher-workshops conducted in the southeastern U.S. For the design, teachers suggested student-centered design. Additionally, although teachers' perspective-taking approaches as students were identified, teachers need further professional development to engage in deeper thinking regarding how and why students learn with game-based math learning. For the implementation, categories of time limitation, sequence-related integration, the target student groups, and the course types for game-based learning are observed.

Contributors

Fengfeng Ke, Florida State university

Yanjun Pan, Florida State university

1 PM ET

Session: #31 - Posters

Investigating Urban HS Students' Math Attitudes Using Equitable Practices

Brian Dossey, Baylor University

Brian Dossey, Baylor University

Abstract

Join us as we examine a quantitative study demonstrating that using the mathematics workshop approach (Sharp et al., 2019) with urban high school students creates a more equitable environment to learn and improves attitudes towards mathematics at the same time measured by the Attitudes Towards Mathematics Inventory (Lim & Chapman, 2013).

Contributors

1 PM ET

Session: #31 - Posters

Bob's Engagement in Fraction Multiplication Tasks

Jessica Hunt, North Carolina State University

Jessica Hunt, North Carolina State University

Abstract

Productive engagement in fractional reasoning is essential for abstracting fundamental algebraic concepts vital to college and career success. Yet, data suggests students with learning disabilities (LD), in particular, display pervasive shortfalls in mastering fraction content. Shortfalls in understanding are issues of access that students have to productively engage with learning objects that meaningfully bring forward and connect students' fractions understanding with their whole number understandings. In this study, we take up a case study methodology to illustrate patterns of behavioral, affective, and cognitive elements of Bob, one student with LD, as he engages with a series of fraction tasks designed to support his engagement. Results reveal patterns of productive engagement as regards this student's number and fractional reasoning as they relate to the tasks he was given over time. Contributions of this work include considerations for future research and practice seeking to promote productive engagement by design.

Contributors

1 PM ET

Session: #31 - Posters

Are Pre-Pandemic Programs Enough? A Review of Early Math Interventions

Robyn Pinilla, Southern Methodist University

Robyn Pinilla, Southern Methodist University

Abstract

When all children have missed opportunities to learn, how do educators triage students appropriately to accelerate mathematics learning? What content and context should be privileged in the race to provide appropriate foundations while instructing on guiding standards? This review of recent literature examines studies of early mathematics interventions published post-NCLB to consider instructional delivery format and children's numeric and spatial reasoning development. Results showed that most supplemental mathematics interventions for pre-kindergarten through second-grade children focused on number sense and were delivered face-to-face. While many programs led to improved student outcomes, effect sizes of the interventions were smaller on assessments distal from directly instructed skills. These findings suggest the need to diversify intervention content and delivery format. Researchers should investigate hybrid interventions that include face-to-face and computer-assisted intervention components as we continue to embrace technology's benefits and begin recovering from the impacts of the COVID-19 pandemic on education.

Contributors

1 PM ET

Session: #31 - Posters

Elementary teachers' reports of their mathematics instruction before and during the COVID-19 pandemic

Babette Moeller, Education Development Center

Babette Moeller, Education Development Center

Abstract

As part of a federally funded grant, we conducted Math for All professional development workshops at elementary schools in the Midwest to support teachers' implementation of high-quality, standards-based mathematics education for a wide range of students, including those with disabilities. Our research included week-long instructional logs administered during the 2019-20 and 2020-21 school years. These instructional logs from a small sample of K-5 teachers (n=22 at three rural districts, and n=53 at an urban district) help describe the nature of mathematics instruction and teachers' lesson planning practices prior to (October 2019 - early March 2020) and during the COVID-19 crisis (April-May 2020, and the 2020-21 school year). Our findings demonstrate the need for more support for teachers in the areas of lesson planning and differentiating instruction, to enable them to be more flexible and to be better prepared to address diverse students' needs under challenging instructional conditions.

Contributors

Teresa Duncan, Deacon Hill Research Associates

Jason Schoeneberger, ICF

John Hitchcock, Westat

1 PM ET

Session: #31 - Posters

Obstacles in learning Horizontal Transformation of Functions

Yuriko Brown, The Pennsylvania State University

Yuriko Brown, The Pennsylvania State University

Abstract

Transformation, especially horizontal transformation of functions has been considered one of the most challenging topics in pre-calculus from the perspective of both teachers and students.

Researchers have investigated the subject and confirmed that students find horizontal transformation counter-intuitive, they tend to rely on memorization of the formula, and their difficulties are related to their inefficient understanding of function.

Undergraduate students are the subject of this study. How their obstacles are related to their inefficient understanding of function are analyzed by coordinating APOS theory and Duval's theory. APOS theory is used to determine the advanced level of understanding horizontal transformation of functions, and Duval's theory examines the specific obstacles between concept of function and horizontal transformation of functions.

The analysis of the empirical data suggests that one of the main sources of students' obstacles is understanding the Fundamental Graphing Principle for Function, especially covariational (x-y coordinate) representation of function.

Contributors

1 PM ET

Session: #31 - Posters

Enacting Tutoring Best Practices in a University-School System Partnership Model

Tyreeka Williams, North Carolina AT State University

Thomas Coleman, North Carolina A&T State University

Faith Freeman, Guilford County Schools

Tyreeka Williams, North Carolina AT State University

Abstract

Project Math Success (PMS) is a non-professional mathematics tutoring program between Guilford County Schools and North Carolina A&T State University. PMS seeks to enact tutoring best practices (Alegre, Moliner, & Maroto, 2018) within a novel, community partnership model. Our research goal is to understand how the enactment of tutoring best practices within this model impacts the lives of tutors and tutees. Qualitative research methods aim to capture the lived experiences of participants, assess the utility of this novel model for mathematics tutoring, add to the body of literature that examines non-professional tutoring, and inform future work within schools and school systems. While results are pending, this poster will communicate tutoring best practices and the ways in which these practices are being incorporated within a community-partnership approach to non-professional tutoring. The poster will also include the affordances, limitations, and challenges encountered thus far.

Contributors

Thomas Coleman, North Carolina A&T State University

Faith Freeman, Guilford County Schools

Paula Price, North Carolina AT State University

1 PM ET

Session: #31 - Posters

Building an Anti-deficit Framework for Valuing Thinking About $.999\dots = 1$

Josh Hertel, University of Wisconsin - La Crosse

Josh Hertel, University of Wisconsin - La Crosse

Abstract

In this session, we share an anti-deficit framework for recognizing and valuing thinking about $.999\dots = 1$. Discussion will focus on the potential for fostering connections, displaying multiple ways of knowing, and linking together mathematical ideas from different contexts and domains.

Contributors

Sayonita Ghosh Hajra, California State University, Sacramento

Tushar Das, University of Wisconsin - La Crosse

1 PM ET

Session: #31 - Posters

Examining the Intentionality and Purposefulness in Building and Sustaining Educational Partnerships

Trena Wilkerson, Baylor University

Colleen Eddy, University of North Texas

Megan Che, Clemson University

Jamaal Young, Texas A & M University

Trena Wilkerson, Baylor University

Abstract

Join us to examine the intentionality and purposefulness in School-University-Community partnerships in educational endeavors in light of a relative lack of research on systematic partnership processes, particularly in certain disciplines like mathematics education. Partnership is centrally important in educational efforts of a wide variety of instantiations. The partnerships examined include design-based research studies, participatory action research, youth participatory action research, researcher-practitioner partnerships, and community-based participatory research partnerships. Preliminary results include studies about the nature of educational partnerships and their processes are relatively rare and small-scale compared to the prevalence of partnership and research engagement across different types of partnership configurations. Further there is often a lack of intention or purpose and at times a definition of partnership. As a study in progress, we would like to engage in discussions about intention and purpose in partnerships that participants are engaged or plan to engage in the future.

Contributors

Colleen Eddy, University of North Texas

Megan Che, Clemson University

Jamaal Young, Texas A & M University

Tina Mitchell, Delaware State University

1 PM ET

Session: #31 - Posters

Exploring a Student's Self-Regulatory Activities in Tasks of Varying Cognitive Demands

T. Royce Olarte, University of California, Santa Barbara

T. Royce Olarte, University of California, Santa Barbara

Abstract

This study examined how an undergraduate mathematics student metacognitively engaged in tasks of varying cognitive demands and how they reflected on their efforts. I used Zimmerman's cycles of self-regulation to better understand the problem-solving experience and the sense-making efforts of a student working on two number theory-related tasks. Qualitative data analysis was used to examine the student's participation in a task-based interview involving a think-aloud protocol and a semi-structured interview that prompted the student to reflect on their efforts. In the routine task, the student used more formal approaches, relied on their prior experiences with similar tasks to guide and monitor their efforts, and had more positive affect. In the non-routine task, the student used a broader range of approaches, monitored their progress using the phrasing of the task, and exhibited more negative affect. The findings contribute to the body of literature on metacognition and problem-solving in undergraduate mathematics.

Contributors

2 PM ET

Session: #41 - Interactive Session

Funding Opportunities for Mathematics Education Research at the National Science Foundation

Margret Hjalmanson, National Science Foundation

Margret Hjalmanson, National Science Foundation

Deena Khalil, National Science Foundation

Eric Knuth, National Science Foundation

Abstract

The Education and Human Resources Directorate (EHR) at the National Science Foundation has a variety of funding opportunities that support innovative projects in mathematics education. The Directorate seeks to be a catalyst for change by advancing theory, methods, design, applications, and research in STEM education. Programs across EHR focus on research and innovation in formal and informal settings for mathematics education across the lifespan. In this session, program directors from the Education and Human Resources Directorate of the National Science Foundation will describe current funding opportunities and provide opportunities to ask questions about current NSF programs. We will also have breakout rooms for small group discussion of different funding opportunities with program officers.

Contributors

Elise Lockwood, National Science Foundation

Finbarr Sloane, Nat

Michael Steele, Nati

2 PM ET

Session: #42 - Research Paper

A Case Study of Reform Efforts to Improve Math Instruction Through Coordinated PD

Astin Sarrell, Jacksonville State University

Abstract

While research connects effective professional development to improved instructional practices, there is still a need for additional research on what this professional development should entail for elementary mathematics classrooms. This qualitative case study sought to determine how one school coordinated its PD efforts in mathematics instruction. The study took place at a rural, pre-K through fourth grade school in east Alabama. The study collected data on the specific opportunities afforded to teachers throughout one semester of focused efforts on mathematics instruction and on the impact the efforts had on classroom instructional practices. All professional development efforts centered on the use of number talks. Analysis of the data revealed that it is important that all development efforts align to meet the overall goal, which includes the development of a strong teacher subsystem. The results also indicated that number talks implemented in elementary mathematics classrooms can have positive impacts on instructional practices.

Contributors

Astin Sarrell, Jacksonville State University

2 PM ET

Session: #42 - Research Paper

Using and Transforming Mathematics Education Pedagogy in a Broadcast Setting

Jessica Hunt, North Carolina State University

Abstract

The COVID-19 pandemic prompted a shift in K-12 educational delivery from primarily in-person classroom instruction to remote learning. Developing broadcast instruction is one way to provide learners who experience barriers to contemporary forms of remote learning. There is some interplay between design principles used in mathematics-focused broadcast television programs and mathematics classroom pedagogy. Yet, more research is needed to understand how teachers may adapt mathematics education design principles to develop broadcast lessons. We utilized an exploratory case study design to investigate how teachers conceptualized, enacted, and reflected upon mathematics pedagogy in a broadcast environment. Data from lessons, feedback sessions, and semi-structured interviews were collected and analyzed. Results yielded three themes related to the instructional design, barriers and challenges, and equity: (a) Goal-focused planning and delivery, (b) Centrality of discourse, and (c) Time. We will discuss the results in relation to prior work at the intersection of mathematics and broadcast pedagogy.

Contributors

Jessica Hunt, North Carolina State University

Alejandra Duarte, North Car

Rebekah Davis, North

2 PM ET

Session: #42 - Research Paper

Acts towards Entry, Engagement and Empowerment for/with Emergent Bilinguals

Ricardo Martinez, University of Nebraska-Lincoln

Abstract

Teaching mathematics for Emergent Bilinguals (EBs) presents multiple possibilities by connecting language to culture and culture to mathematics when fostering equitable teaching. The purpose of this paper is to conceptualize 5-Act Task for EBs centered on entry, engagement, and empowerment within a paradigm of mathematical modeling. Particularly, we suggest and explore a 5-Act Task framework that expands Dan Meyer's 3-Act Task by explicitly focusing on how teachers can engage EBs in meaningful mathematical learning before and after the standard 3-Act Task. The 5-Act Task Framework enables teachers to create opportunities of empowerment for EBs in experiencing meaningful communication and deepening mathematical understanding through the modeling process. Wherein, teachers will be able to use modeling to effectively teach EBs while using rich cognitively demanding tasks and allow for space to development language.

Contributors

Ricardo Martinez, University of Nebraska-Lincoln

Ji-Yeong I, Iowa State

Betsy Araujo Grando, Iowa State

2 PM ET

Session: #43 - Research Paper

Exploration of Visual Art and 3D Geometry Approaching Mathematical Modeling

Rose Mary Zbiek, The Pennsylvania State University

Gina Foletta, The Pennsylvania State University

Abstract

Mathematical modeling requires connections between a complex real-world context and mathematical ideas. Connections depend on how students choose and mathematically treat attributes of objects as one component of an overall mathematical modeling process. To zoom in how K-12 students authentically move between real-world objects and mathematics, we ask students to explore a previously unveiled work of visual art in which mathematics in general and geometry in particular are explicitly and implicitly present. Our attention to shape complements common attention to quantity in mathematical modeling research. Spatial visualization literature informs data analysis. Findings indicate how students use notably different relationships between parts of the art to dissect the artwork and create with its elements. Implications include how teachers might support students' authentic thinking about shape in real-world situations. The study is the first in a set of studies that explore how students engage in components of mathematical modeling individually and collectively.

Contributors

Rose Mary Zbiek, The Pennsylvania State University

Gina Foletta, The Pennsylvania State University

2 PM ET

Session: #43 - Research Paper

Persistence of playing school: Examining an immersive 90-day semester-program for shaping students' mathematical perceptions and practices

Amanda Brown, University of Michigan

Justin Dimmel, University of Maine

Carolyn Hetrick, University of Michigan

Ed Silver, University of Michigan

Chandler Brown, University of Michigan

Abstract

In this paper, we report on a study in which we investigated the outcomes of a 90-day immersive semester-program located on an island in the western Atlantic Ocean that utilizes an immersive place-based curriculum for shaping students' learning. Using interviews and surveys, we investigated how students describe their mathematical experiences in the program, changes in students' attitudes towards mathematics, and students' tendencies to engage in sense making (drawing on realistic considerations) in the context of story problems administered during their time in the program. Our findings suggest that while students' experiences in an immersive mathematical experience outside of school may support them in gaining more productive dispositions towards mathematics, it may not be enough to support students in "unlearning" the norms regarding the suspension of sense-making associated with doing story problems in school.

Contributors

Amanda Brown, University of Michigan

Justin Dimmel, University of Maine

Carolyn Hetrick, University of Michigan

Ed Silver, University of Michigan

Chandler Brown, University of Michigan

2 PM ET

Session: #43 - Research Paper

Investigating Possibilities for Aesthetics of Inquiry in Math Education

Alesia Moldavan, Fordham University

Abstract

Although significant undertakings have enhanced school mathematics teaching and learning (e.g., CCSSM, 2010; NCTM, 2014), there is still a need to further explore what counts as mathematics and the various ways inquiry practices and engagements can be experienced across settings. This study analyzes different types of aesthetics of inquiry (e.g., Sinclair, 2004) emerging in an episode of interaction that occurred in an urban high school afterschool program focused on social-justice documentary film production. In particular, we report on the emergence of two different inquiry practices (i.e., collective and fragmented) and the surfacing role of frame rate in video production as a sensorial meaning-making tool to elicit deeper understanding of proportional reasoning. We illustrate alternative ways to leverage feelings and meaning-making when learning, thereby investigating the ontological possibilities for aesthetics of inquiry in mathematics education.

Contributors

Alesia Moldavan, Fordham University

Jasmine Ma, New York University

Daniela Della Volpe, New York University

Molly Kelton, Washington State University

2 PM ET

Session: #44 - Research Paper

Using Community Funds of Knowledge to Write Mathematical Problems

Ricela Feliciano-Semidei, Northern Illinois University

MARIANA RICKLEFS, Northern Illinois University

Abstract

This qualitative case study examines the use of community funds of knowledge (CFofK) to write relevant mathematical word problems. The participants were a group of secondary mathematics preservice teachers (PSTs) from a university in the Caribbean Region of Colombia. PSTs wrote reports explaining how they perceived mathematics applied in the everyday life activities of their rural community, then, wrote a related mathematical word problem. Data collection and analysis procedures ensured a triangulated data set. Data was analyzed using several rounds of focused coding, cross-validation, and inter-rater reliability. Findings from this study showed that PSTs addressed seven categories of CFofK, five mathematical domains and ten mathematical concepts when writing their reports. Most PSTs used business and farming as CFofK. Additionally, most PSTs used the numerical domain in their reports, but relied heavily on the use of algebra when writing word problems. The study ends with implications for mathematics teacher education.

Contributors

Ricela Feliciano-Semidei, Northern Illinois University

MARIANA RICKLEFS, Northern Illinois University

Yolima A. Rocha-Fontalvo, Universidad del Atlantico

2 PM ET

Session: #44 - Research Paper

Personalization of College Precalculus Tasks: Impacts of Task Construction

Lauretta Garrett, Tuskegee University

Li Huang, Tuskegee University

Kelly Guest, Tuskegee University

Byunghoon Lee, Tuskegee University

Abstract

We will examine student verbal written responses on pre-calculus tasks that use data selected by students based upon their interests. Student work on similar tasks using teacher-selected data contexts will also be examined. This report describes qualities in student work from both implementations, reports codes resulting from qualitative analysis, and examines the impact of changing the structure of the verbal prompts from one semester to the next. Results provide insight into the impact of personalization of tasks and of the wording and structure of verbal response prompts.

Contributors

Lauretta Garrett, Tuskegee University

Li Huang, Tuskegee University

Kelly Guest, Tuskegee University

Byunghoon Lee, Tuskegee University

2 PM ET

Session: #44 - Research Paper

Task Design Cycle and Preservice Elementary Teachers' Understanding of Properties of Quadrilaterals

Seyedekhadijeh Azimi Asmaroud, Illinois State University

Jeffrey Barrett, Illinois State University

Abstract

Students should learn some definitions of geometric shapes in school mathematics (Hals, 2020). The motivation for this study is the existing problem in preservice and in-service elementary teachers' understanding of definitions and properties of two-dimensional shapes (Cunningham & Roberts, 2010; Marchis, 2012) that can affect the quality of their teaching (Shulman, 1986). This study aims to find appropriate tasks to improve 27 Pre-service Elementary Teachers' (PSTs) understanding of definitions of quadrilaterals. Thanheiser's (2016) task design cycle and van Hiele's theory were used to design tasks about defining and categorizing quadrilaterals. PSTs' written answers and their relevant discussions gave a way of describing changes over time for their understanding of properties of the quadrilateral. Patterns of PSTs reasoning and modifications for the tasks provided in this study may help mathematics teacher educators and researchers understand the extent and the difficulty of struggles PSTs have and could help in designing appropriate tasks.

Contributors

Seyedekhadijeh Azimi Asmaroud, Illinois State University

Jeffrey Barrett, Illinois State University

2 PM ET

Session: #45 - Interactive Session

Leveraging Coaches to Close Middle School Math Teachers' Knowing-Doing Gap

Jennifer Gonzales, Baylor

Jennifer Gonzales, Baylor

Abstract

This session will reveal the initial findings for a study exploring the relationship between mathematics teachers' knowledge, beliefs, and the implementation of Mathematics Teaching Practices by focusing on the ongoing and specific teacher support provided by Instructional Coaches. By focusing directly on each teacher's unique barriers and perspectives, this study aims to provide equitable support to all middle school mathematics teachers. The initial findings from this experimental mixed-methods design will be shared related to the following research questions: (1) What are the barriers to implementing effective teaching practices that emerge for middle school mathematics teachers? (2) How will the specific barriers collected from interviews with middle school mathematics teachers provide context for the instructional coaching cycles? And (3) Do levels of implementation for effective teaching practices improve after instructional coaching cycles specifically focused on removing barriers for middle school mathematics teachers?

Contributors

3:30 PM ET

Session: #51 - Interactive Session

Art and technology in online teaching and learning of middle school geometry: Deepening geometrical thinking of preservice and in-service teachers

Irina Lyublinskaya, Teachers College, Columbia University

Marta Cabral, CUNY College of Staten Island

Irina Lyublinskaya, Teachers College, Columbia University

Marta Cabral, CUNY College of Staten Island

Abstract

Mathematics and art have many concepts in common. One of the most productive ways to integrate art and mathematics is to have students create designs based upon mathematical concepts. An understanding of geometric shapes and their properties (area, volume, and symmetry) and geometric transformations, is fundamental to both, mathematics and art. However, traditional mathematics teaching tends to focus more on cognitive understanding, while art tends to value an embodied knowledge that might not always be expressed through words. This interactive workshop is based on a research study that stemmed from a collaboration between mathematics and visual arts education faculty, aiming to understand the ways in which creative aspects of both disciplines could be combined to deepen middle school teachers' understanding of geometric concepts that are difficult to teach and to improve their teaching of these topics.

Contributors

3:30 PM ET

Session: #52 - Research Paper

Challenges in Assessing Teachers' Pedagogical Representation Competence

Jinqing Liu, Indiana University Bloomington

Erik Jacobson, Indiana University Bloomington

PAVNEET BHARAJ, Indiana University Bloomington

Theodore Savich, Indiana University Bloomington

Abstract

Substantial progress has been made in assessing teachers' knowledge by designing multiple choice items. However, scholars have also found that multiple choice items have limitations for measuring specific kinds of content knowledge for teaching. In this study, we investigated whether these limitations also existed when measuring teacher pedagogical content knowledge, and specifically, knowledge for selecting useful pedagogical representations for teaching fraction and decimal arithmetic. We used eight multiple choice items and conducted think-aloud item response interviews with nine fourth grade teachers to examine the alignment between teachers' interpretation of items and researchers' intended inferences from the item responses as well as the relationship between teachers' accuracy rate on these items and their pedagogical representation competence as reflected during the interviews. We report cases of consistency and inconsistency between the intended inferences from multiple choice responses and teachers' verbal justifications, and we discuss the underlying reasons and implications of these findings.

Contributors

Jinqing Liu, Indiana University Bloomington

Erik Jacobson, Indiana University Bloomington

PAVNEET BHARAJ, Indiana University Bloomington

Theodore Savich, Indiana University Bloomington

3:30 PM ET

Session: #52 - Research Paper

An Examination of Elements of Effectiveness of Experienced Elementary Mathematics Teachers Entering Professional Development

Kayla Myers, Georgia State University

Susan Auslander, Georgia State University

Jedonia Cooper, Gwinnett County Public Schools

Angela Turner, Gwinnett County Public Schools

Abriel Moore, Gwinnett County Public Schools

Abstract

This 5-year mathematics professional development project involves 27 elementary teachers being prepared and supported as Elementary Mathematics Specialists (EMSs). Participants will complete our university's endorsement programs in K-5 Mathematics as well as Teacher Supporting & Coaching, participate in Professional Learning Communities, engage in individual mentoring, and mentor teacher candidates. Across the project, data will be gathered to examine changes in mathematical content knowledge, instructional and coaching practices, beliefs, and teacher leader skills of the EMSs. Described here are Year 1 data from the participants, who have been identified as successful, experienced teachers, focusing on specific elements of teacher effectiveness. The findings illuminate their classroom instructional practices, including those that are learner-centered and equitable, along with their early histories as learners of mathematics.

Contributors

Kayla Myers, Georgia State University

Susan Auslander, Georgia State University

Jedonia Cooper, Gwinnett County Public Schools

Angela Turner, Gwinnett County Public Schools

Abriel Moore, Gwinnett County Public Schools

3:30 PM ET

Session: #52 - Research Paper

Investigating Inservice Elementary Teachers' Mathematics Efficacy

Baye Ballew, Saint Leo University

Giang-Nguyen T. Nguyen, University of West Florida

Abstract

This qualitative phenomenological study explores the lived experiences of female elementary teachers' self-efficacy beliefs about teaching mathematics. Bandura's social learning theory was used as the theoretical framework for the study. The social learning theory is based on the cognitive processes and how self-regulation and motivation factor into the personal progress of the development of beliefs. Data were collected through interviewing participants related to their lived experiences related to beliefs about teaching mathematics. First, these participants described experiences in elementary grades as encouraging and supportive; however, transitions to secondary grades changed mathematics attitudes to primarily negative, continuing to college. Second, student-centered experiences with mathematics provided positive influences toward the development of self-efficacy in math instruction. Lastly, participant characteristics pertaining to planning math lessons and instructional self-efficacy were perceived as positive.

Contributors

Baye Ballew, Saint Leo University

Giang-Nguyen T. Nguyen, University of West Florida

3:30 PM ET

Session: #53 - Research Paper

“Quiero Llegar a Ser Alguien”: Community Cultural Wealth in Math Classrooms

Kevin Pelaez, San Diego State University

Ernesto Calleros, San Diego State University

Jose Parra, San Diego State University

William Zahner, San Diego State University

Abstract

We illustrate the use of Yosso' (2005) Community Cultural Wealth (CCW) asset-based framework for highlighting the different forms of cultural capital that students bring into secondary mathematics classrooms. We use counterstories from Critical Race Theory to illustrate the assets that Leyla, a student who recently arrived in the USA from México, brings into a classroom in the Southern California borderlands. Leyla draws on the multiple forms of capital (aspirational, familial, linguistic, social) to navigate within oppressive schooling structures and, in the process, uses resistance capital to identify, critique, and work within those structures. We end by providing teaching and research implications that challenge normative ideologies and school practices, shifting from a perspective that relies on power hierarchies that place teachers as the holders of knowledge and behavior management to a more humanizing relationship where students work alongside teachers and are seen as critical agents of the classroom community.

Contributors

Kevin Pelaez, San Diego State University

Ernesto Calleros, San Diego State University

Jose Parra, San Diego State University

William Zahner, San Diego State University

3:30 PM ET

Session: #53 - Research Paper

Self-Determination Theory and Middle School Mathematics Teachers

Amy Crawford, Ashland University

Abstract

The research study utilized Self- Determination Theory as a framework to research the motivation behind middle school mathematics teachers' will to pursue professional development to satisfy internal needs of self-improvement involving instructional methods in order to ensure success in the classroom involving both mathematics instruction and assessment. The results of the findings of the study indicated the three basic psychological needs of autonomy, competency and relatedness must be met to foster intrinsic motivation in middle school mathematics teachers that participated in this study. Those teachers that were intrinsically motivated were more likely to engage in effective professional development and exceed expectations conveyed by their districts. Effective professional development incorporates a learning environment that acknowledges the research regarding adult learning contexts, including aspects of situated learning.

Contributors

Amy Crawford, Ashland University

3:30 PM ET

Session: #53 - Research Paper

Transforming Prognostic Framing as Evidence of Mathematics Teacher Learning in a Collegial Community of Practice

Joseph DiNapoli, Montclair State University

Abstract

We studied the professional development (PD) of secondary mathematics teachers and their learning. We designed and refined a PD model that embeds three components of effective PD by incorporating the Teaching for Robust Understanding (TRU) Framework for powerful and equitable mathematics learning environments, video-case studies, and high-quality educational resources in the form of formative assessment lessons. Situated in the theoretical perspective of communities of practice (CoP), we studied a group of teachers participating in our PD in an urban setting. Using frame analysis, results showed that teachers' participation within the CoP was changing over time, as evidenced by improving TRU alignment within transforming prognostic frames. Also, these participation changes were informing new reifications of TRU concepts. In other words, teachers within the CoP collegially began building off of each other's prognoses during later PD sessions in ways that were closely aligned to TRU's focus on creating powerful and equitable classrooms.

Contributors

Joseph DiNapoli, Montclair State University

Victoria Bonaccorso, Montclair State University

Eileen Murray, Math for America

Douglas O'Roark, Depaul University

3:30 PM ET

Session: #54 - Research Paper

Developing Preservice Teachers' Noticing of Knowledge Bases and Productive Struggle

Shawnda Smith, Texas Woman's University

Abstract

This study examines the development of preservice teachers' (PSTs) understanding of the connections between teacher actions and use of resources that support productive struggle in a semester-long mathematics content course through video analysis. Our qualitative case study examines 6 PSTs in two sections of a mathematical content course for prospective elementary teachers. The PSTs completed writing assignments analyzing student struggles in video episodes using the Productive Struggle Framework (Author, 2015). The assignments were analyzed, focusing on connections PSTs described between the student struggle(s), interpretation of student thinking, teacher actions, and the teacher's use of multiple student resources. Findings show that PSTs made frequent connections between student struggles and the teacher actions, but fewer connections between the resources and student struggles or teacher actions. PSTs also viewed the productive level of the struggle episode through a progress-focused or answer-focused lens, and some incorporated teacher actions and resource use into their justifications.

Contributors

Shawnda Smith, Texas Woman's University

Christine Herrera, California State University Chico

Christina Starkey, Kentucky Wesleyan College

Hiroko Warshauer, Texas State University

3:30 PM ET

Session: #54 - Research Paper

What do AP Calculus teachers believe leads students to be successful in their course?

Veronica Faraci, St. John's University

Abstract

In this case study the opinions of two Advanced Placement (AP) Calculus teachers are being cross examined. After a review of literature and analysis of the interviews in this study, there were many areas of convergence and divergence which leads to an introduction of a non-linear framework; peer support and discourse in the classroom, increased motivation, and ability to apply content to real world situations. In our current educational climate, Science, Technology, Engineering, and Mathematics (STEM) is the buzz term. The STEM pipeline is referenced by my many politicians in order to develop citizens with educational and career qualities to solve the problems that our global world faces. It is essential to research the opinions of practitioners who are positioned in the field in order to understand the data that is manifesting in current research and data collection.

Keywords: AP Calculus, success, STEM career, teacher opinions

Contributors

Veronica Faraci, St. John's University

3:30 PM ET

Session: #54 - Research Paper

Pedagogical Content Knowledge of Statistics: It's Not Just for Teacher Preparation Programs Anymore

Randall Groth, Salisbury University

Abstract

Pedagogical content knowledge (PCK) is an important part of teacher preparation. PCK helps teachers make subject matter comprehensible to others. However, teachers are not the only ones with this responsibility. During the COVID-19 pandemic, the public needed to understand certain core statistical principles underlying the fight against the pandemic. Those in government, social media, medicine, and the news were given public platforms that could be used to foster such understanding. Unfortunately, there were several missed opportunities to help the public develop and act on this understanding. Three specific missed opportunities are analyzed. They deal with the statistics subject matter of experimental study design, univariate distributions, and big data analysis algorithms. Collectively, the examples suggest that PCK in statistics should not be considered solely a component of teacher preparation. Those responsible for communicating public health messages need to be able to make statistical principles comprehensible to a broad audience as well.

Contributors

Randall Groth, Salisbury University

3:30 PM ET

Session: #55 - Research Paper

Online Homework Support Changes Mathematics Teaching Practices

Mingyu Feng, Wested

Abstract

When students do homework, an online tool such as ASSISTments can provide immediate feedback and can organize students' practice according to research-based principles. When homework is online, teachers can more easily monitor student work, use student work in their discussions, and see which problems presented challenges. Doing homework online can lead to adaptive pedagogies. We report on a large-scale replication study of the efficacy of ASSISTments involving 100+ 7th-grade teachers from 63 middle schools in the state of North Carolina. The overarching questions examine the impact of ASSISTments on student learning. Herein we focus specifically on how teachers' practices change when they use online homework. We report findings of analysis based on multiple sources of data including surveys, logs, interviews and classroom observations.

Contributors

Mingyu Feng, Wested

Jamie Gillespie, North Carolina State University

3:30 PM ET

Session: #55 - Research Paper

Middle School Students' Use of Literacy Strategies in Solving Mathematical Word Problems

JANE WILBURNE, Penn State Harrisburg

Abstract

What subject comes to mind when the word literacy is mentioned? This study will highlight middle-school students' use of literacy strategies in connection with solving mathematical word problems. We begin with a comparison between disciplinary and content area literacy, and a summary of the literacy strategies mathematically proficient students implement when solving mathematical problems. We present samples of the strategies students used and discuss ways teachers can promote the use of these strategies so that each and every student has access to effective approaches in solving mathematical problems.

Contributors

JANE WILBURNE, Penn State Harrisburg

5 PM ET

Session: #61 - Interactive Session

A study involving diagnostic competence and virtual-reality simulations

Enrique Ortiz, University of Central Florida

Enrique Ortiz, University of Central Florida

Abstract

This study involved TeachLive virtual-reality simulation diagnostic tasks to assess and develop pre-service teachers' diagnostic competence self-efficacy. Diagnostic competence involves the teachers' ability to listen and notice student thinking in a profound manner utilizing proper questioning techniques. The participants were presented with mathematics computation error pattern simulations and allowed to practice critical aspects of the diagnostic process. The recorded sessions lasted about ten minutes for each participant, which they used for self-assessment. The error patterns involved subtraction computation of two- and three-digit numbers. Self-efficacy scale, student-avatar scripts, performance protocol to conduct diagnostic interview, and diagnostic assessment checklist to self-assess performance in simulation developed for this study will be presented. The use of the student avatars for this and other purposes will be demonstrated and discussed. Participants provided insightful information about their perceptions of self-efficacy, and use of diagnostic protocol and checklist. Findings from the study will be discussed.

Contributors

5 PM ET

Session: #62 - Research Paper

Zearn Math Curriculum Efficacy During Quarantine and a Typical Year

Katherine Pettrey, Louisiana State University (Unable to Present Live).

Abstract

Zearn is a nation-wide K-5 blended mathematics curriculum utilizing a virtual learning platform combined with small group classroom instruction. Data about student usage at a typical Title I elementary school were analyzed to determine effects on student proficiency over a three-year phased-in implementation, as well as the impact on student proficiency over a typical school year of full Zearn usage. Effects of Zearn as the math curriculum for both neurotypical students and students with diverse needs will be presented, as well as information about student access and usage during the COVID-19 quarantine.

Contributors

Katherine Pettrey, Louisiana State University

5 PM ET

Session: #62 - Research Paper

Impact of Online Professional Learning on Early Math Teacher's Perspectives of Practice

Jessica Hunt, North Carolina State University

Abstract

Disparities in mathematics achievement can appear as early as Kindergarten and have lasting impacts on young students' success. Few studies have examined the impact of professional development designed to bolster knowledge of young children's mathematical development on beliefs. In this study, we evaluated whether participants' beliefs changed significantly after engaging in online professional learning on teaching math to young children, overall orientations of participants' teaching practices and shifts over time, and how changed beliefs might coincide with changed orientations to practice. We employed a multi-level mixed methods design, with quantitative results showing changes in teachers' overall beliefs based on survey data. We discuss how shifts in perceived instructional practices coincide with beliefs found to be statistically significant in the quantitative analysis and the potential for online professional development to influence beliefs. Implications for future research are shared.

Contributors

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5 PM ET

Session: #62 - Research Paper

Using a Tablet App to Foster Data Collection and Analysis Learning with Preschoolers

Ashley Lewis Presser, EDC

Jessica Young, EDC

Abstract

To prepare young children to use and learn from data, we engage preschoolers in a series of investigations to answer child-friendly, real-world questions. With a design-based research approach, this project develops and tests a classroom-based intervention that leverages a teacher-facing digital app to facilitate collaboration between preschool teachers and children as they collect data, create simple graphs, and use graphed data to engage in “data talks.” Throughout, children are applying numerous other mathematics skills, such as counting, sorting, classifying, comparing, and contrasting. Findings from the co-design process and piloting suggest that the investigations and app support preschool teachers and children as they engage in and learn from the data collection and analysis process. Teachers reported that this developmentally appropriate approach complements existing curricular activities and that children demonstrate readiness to engage with, and benefit from, the investigations. These findings suggest further study of the approach is warranted.

Contributors

Ashley Lewis Presser, EDC

Jessica Young, EDC

5 PM ET

Session: #63 - Research Paper

A Case Study of Teachers' Use of an Online Homework Tool During In-Person and Remote Instruction

Jamie Gillespie, The Friday Institute for Educational Innovation, NC State

Kevin Winn, The Friday Institute for Educational Innovation, NC State

Malinda Faber, The Friday Institute for Educational Innovation, NC State

Abstract

Since 2017, the Friday Institute for Educational Innovation has participated in a replication study of the impact of ASSISTments, a free online learning tool for student mathematics achievement. We conducted an intrinsic, longitudinal multiple-case study of middle school teachers' implementation of ASSISTments and its impact on their instruction before and during the COVID-19 pandemic. The study examined teachers' use of ASSISTments in three instructional contexts: in-person only, remote only, and both in-person and remote. Our findings indicate that teachers in all environments changed their instructional practices around homework review by using ASSISTments reports to target review based on students' performance.

Contributors

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Kevin Winn, The Friday Institute for Educational Innovation, NC State

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5 PM ET

Session: #63 - Research Paper

A Longitudinal Analysis of Perceived Teacher and Peer Support on Motivation and Achievement in High School Mathematics

James Middleton, Arizona State University

Abstract

The relationship among perceived teacher and peer support, mathematics engagement, and achievement was studied in first year high school students in the Southwest US. Teacher and peer support are hypothesized to impact students' engagement directly and in concert as they make up the classroom academic support climate (Federici & Skaalvik, 2014; Klem & Connell, 2004). Teacher and student support, students' personal interest, self-regulation, and self-efficacy in mathematics were measured at two time points: At the beginning of the freshman year of high school, and at the end. Achievement was assessed by the state mathematics proficiency examination. A well-fitting longitudinal path analysis supported the hypothesized model of relationships. Results show that peer support becomes more important over time, mediating perceived teacher support. Achievement was impacted primarily by the level of students' personal interest at the end of their freshman year, but interest was strongly influenced by students perceptions of their peers.

Contributors

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5 PM ET

Session: #63 - Research Paper

Relational Tenacity in Teacher-Student Relationships during COVID

Drew Nucci, University of Washington

Abstract

This study responded to the COVID-induced transition to mandatory-online learning environments (MOLE) in schools. It sought to understand how the drastic change in learning environments impacted a secondary mathematics department's equity-oriented pedagogy and the teacher-student relationships that undergirded it. This study investigated how teachers understood their cultivation of positive, autonomy-supportive relationships (Reeve, 2006) to motivate students to participate and interact in the MOLE. Data sources included teacher interviews, teacher focus groups, and student focus groups. Mathematics teachers reported wide disparities in participation, interaction, and relationships in the MOLE that undermined their ability to enact social problem solving. Teachers said that absent reciprocity in person they would ordinarily use their bodies in shared space to forge relationships tenaciously with reticent students. Based on these findings, I theorize the importance of relational tenacity, or the long-term sustained effort that teachers expend to form positive relationships with students and suggest future research directions.

Contributors

Drew Nucci, University of Washington

5 PM ET

Session: #64 - Research Paper

Synthesizing Research to Elevate Mathematics Specialist Positioning

Courtney Baker, George Mason University

Katherine Edwards, George Mason University

Kristin Harbour, University of South Carolina

Evthokia Saclarides, University of Cincinnati

Margret Hjalmarson, George Mason University

Abstract

For the past forty years, United States school districts have increasingly hired mathematics specialists to support the teaching and learning of mathematics. Despite the prevalence of this professional development structure, mathematics specialists are a relatively new research topic within the mathematics education field. In this paper, we report findings from an exploration of the positioning of mathematics specialists in empirical literature between 1981 and 2018. Using the McGatha and Rigelman's (2017) framework as an analytic lens, we found that beyond the positions identified in their framework (coach, intervention specialist, teacher), there were four additional mathematics specialist positionings within the research (learner, other p-12 stakeholder, university stakeholder, unknown). Ultimately, we forward an expansion of the McGatha and Rigelman (2017) framework to include these new categories, as well as contextual descriptions and working definitions to support future research in more accurately and robustly capturing the ways in which mathematics specialists are investigated.

Contributors

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5 PM ET

Session: #64 - Research Paper

Understanding Mirroring Effects in Coaching on Mathematics Teaching Practice

Hillary Henry, The University of Pittsburgh

Abstract

It is human nature to learn through mirroring the actions of others, both intentionally and unintentionally. Mirroring is more likely to occur when the person has low self-efficacy, they hold the person they are mirroring in high esteem, and the pair share a strong relationship with perceived similarities. The extent to which mirroring occurs between an instructional coach and teacher has not been extensively discussed. This qualitative case study is an attempt to explore how teachers mirror the questioning techniques of their instructional coaches in their own teaching. This is an in-depth analysis of questioning techniques in teacher-coach pre-lesson conferences and subsequent mathematics lesson transcripts. Discovering whether mirroring is prevalent in these settings can contribute to the practice and preparation of instructional coaches, the teachers they work with, and the students they are connected to.

Contributors

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5 PM ET

Session: #64 - Research Paper

Exploratory analysis on research in mathematics teachers knowledge

Eunhye Cho, Stonehill College

Abstract

This paper is a systematic literature review that aims to identify the major topics of research about the knowledge of mathematics teachers and track the research trends over time. This study is unique as it analyzed an entire collection of 3,485 scholarly articles regarding this topic, published from 1987 to 2021. We used a text mining technique (Latent Dirichlet algorithm, Blei, 2012) and derived 11 underlying topics in the articles. The topic, “professional development,” was found to account for the greatest portion in a collection of the articles. The analysis of research trends over time revealed that the popularity of these topics did not greatly change over time. Here, we discuss how the content knowledge of mathematics teachers may be influenced by research trends over time.

Contributors

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5 PM ET

Session: #65 – Interactive Session

Getting published in JRME and MTE, and more.

Patricio Herbst, University of Michigan, JRME Editor

Michael Steele, National Science Foundation, MTE Editor

6:30 PM ET

Session: #71 - Keynote Session

Keynote - Can research care about people?: Research roles and methods for community building.

Theodore Chao, The Ohio State University

Melissa Adams Corral, California State University—Stanislaus

Abstract

Mathematics Education Research often operates by categorizing humans into three specific roles: Researchers, Teachers, and Students. These categories limit the contributions of all humans within the research process, devaluing the theorizing done by teachers, the teaching done by students, and the learning done by the researchers. In this keynote address, Drs. Chao and Adams Corral share experiences from their own work on building spaces for communities to come together around mathematics storytelling and developing research relationships within an elementary school to question the very nature of roles and methods within mathematics education research.