School Science and Mathematics Association
Annual Convention

Phoenix, Arizona
October 20-22, 2016

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SSMA President Welcome

On behalf of the Board of Directors of the School Science and Mathematics Association, I welcome you to the 115th Annual Convention. We are an international organization that continues to nurture new researchers and practitioners through our meetings. As an intimate, nurturing professional association comprised of a mixture of researchers and practitioners, the activities of SSMA are defined by four goals:

1. To build and sustain a community of educators and researchers in STEM fields.
2. To advance knowledge through research in science and mathematics education, and in their integration and application in the real world.
3. To inform practice through the dissemination of scholarly works in science and mathematics, in our journal, *School Science and Mathematics*.
4. To influence policy in science and mathematics education at all levels of government.

In celebrating 115 years of existence, please extend invitations to your new and experienced science and mathematics colleagues to join our family.
As you involve yourself in the convention sessions, meals and committee meetings, realize that it is people like you who can make a difference in the quality of our educational systems. Join in the friendly discussions about the research, development, teaching and learning of mathematics and science at all levels.
If we have not met, be sure to introduce yourself when you see me.
Enjoy your time in Phoenix as you network with friends and make new acquaintances in your field.

Gil Naizer

SSMA Leadership

President, Gil Naizer, Texas A&M University – Commerce, 2014-2016
President-Elect, Stacy Reeder, University of Oklahoma, 2015-2016

Co-Executive Directors and Convention Chairs

Melanie Shores, University of Alabama Birmingham, 2014-2019
Tommy Smith, University of Alabama Birmingham, 2014-2019

Directors-at-Large

Timothy Laubach, University of Oklahoma, 2013-2016
Ron Zambo, Arizona State University, 2013-2016
Charles Emenaker, University of Cincinnati Blue Ash, 2014-2017
Elaine Tuft, Utah Valley University, 2014-2017
Ken Miller, Montana State University Billings, 2015-2018
Margaret Mohr-Schroder, University of Kentucky, 2015-2018

School Science Mathematics Journal Editors

Shelly Harkness, University of Cincinnati, 2011-2021
Carla Johnson, Purdue University, 2011-2021

Newsletter Editor

Georgia Cobbs, University of Montana, 2013-2016

2016 Program Chairs and Local Arrangements Chairs

Ron Zambo, Arizona State University
Juliana Utley, Oklahoma State University
Adrienne Redmond-Sanogo, Oklahoma State University

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STEAM Rising in Phoenix

Convention Overview

Thursday	Friday	Saturday
7:30-8:15 **Continental Breakfast**	**7:30-8:45** **Breakfast Buffet** **Awards and Business Meeting**	**8:00-9:00** **Continental Breakfast**
8:25-8:50 Breakouts	9:00-9:50 Breakouts	8:30-9:30 Innovation Showcase
9:00-9:50 Breakouts	10:00-10:25 Breakouts	9:40-10:30 Breakouts
10:00-10:25 Breakouts	10:35-11:00 Breakouts	10:40-11:30 Breakouts
10:35-11:00 Breakouts	11:10-11:35 Breakouts	11:40-12:30 Breakouts
11:10-11:35 Breakouts	**12:00-1:30** **Speaker** Dr. David A. Williams **Lunch**	**Explore Phoenix** **Safe Travels!**
11:45-1:00 **Lunch**		
1:10-1:35 Breakouts	1:40-2:05 Breakouts	
1:45-2:35 Breakouts	2:15-3:05: Breakouts	
2:35-2:55 PM Drink Break	**3:15-3:35 PM Drink Break**	
2:55-3:45 Breakouts	3:35-4:15 Breakouts	
3:55-4:20 Breakouts	4:25-4:50 Breakouts	
4:30-5:20 **Committee Meetings**		
5:30-6:30 General Session **Speaker**: Dr. Richard K. Lawrence	**Dinner on your own/Explore Phoenix**	
6:30-8:00 Reception **Cash Bar**	**8:00-10:00 SSMA President Graduate Student Reception Location TBA**	

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Convention Schedule Overview

THURSDAY Morning, October 20					
	8:25-8:50	**9:00-9:50**	**10:00-10:25**	**10:35-11:00**	**11:10-11:35**
Suite S301B	**Research Session** *Using Tutorial Virtual Manipulatives to Enhance Classroom Mathematical Discussion* Anderson-Pence, Tygret	**Research Session** *Mathematics' Teacher Actions: A Q Methodology Study* Wilburne, Franz, Polly	**Research Session** *Elementary Teachers' Perceptions of Engineering, Engineering Education, and Barriers to Teaching Engineering* Hammack, Ivey	**Research Session** *Chemistry Teachers Learn How To POGIL* Caukin	**Research Session** *iTeach ELLs: Efforts in Closing the Achievement Gap* Kelley. Farr
Suite S302B	**Research Session** *Research Experiences for Preservice Science Teachers* Angle	**Research Session** *Using the Reformed Teaching Observation Protocol (RTOP) for Novice Teachers* Bruun, Moore	**Research Session** *Activity-based STEM learning: What our research says about "doing it learning"* **Canceled** Ayhan, Koc, Bozkurt	**Research Session** *Professional Development Schools Partnerships—Beyond Internships and Field Experiences* Cooper	**Research Session** *Perceived Impacts of a Research Experience for Undergraduate Chemistry Majors* Lunsford
Suite S370B	**Research Session** *Inquiry, Projects, and Makerspaces: Bringing Math and Science to Life* Day, Cribbs, Duffin	**Regular Session** *How are early career mathematics teachers being supported?* Amick, Martinez, Taylor	**Research Session** *Discerning Science from Non-science: Pre-service Elementary Teachers Consider Alternative Explanations to Evolution* Bloom, Binns	**Research Session** *Norming the Chamberlin Affective Instrument for Mathematical Problem Solving* Chamberlin, Moore, Parks	**Research Session** *Characterizing Middle School Students' Experiences in a Project-Based Learning Program* Jekkals, Scogin, Kruger
Suite S371B		**Regular Session** *Engaging Young Children and their Families in Science* Czerniak	**Research Session** *Living on the EDGE: Lessons Learned from Project-Based Engineering Education* Alexander, Gruenler. Scogin	**Research Session** *Using a PBL Approach to Foster More Positive Student Attitudes in STEM* Scogin, Kruger, Jekkals	**Research Session** *Formal and informal proofs in secondary geometry* Chavez, Sears
Sierra Ballroom 1	**Research Session** *Linking Formal and Informal Science within an Undergraduate Gardening Experience* Nesmith, Turney, Cole, Sandager	**Regular Session** *STEM Road Map: Integrated STEM Curriculum for Grades 6-8* Walton, Utley, Johnson, Peters-Burton, Sondergeld	**Research Session** *Preservice Teachers' Knowledge of Solving Problems in Different Ways using Decimal Operations* Joung	**Research Session** *Analysis of Larger Mediums for Mental Models of Science and Science Teaching* Peters, Hathcock	**Research Session** *Science Autobiographies: Examining Pre-service Elementary Teachers' Attitudes Towards Science* Pearce, Stewart
Sierra Ballroom 2		**Research Session** *Implementation of Interdisciplinary Co-planning Teams Among Secondary Mathematics and Science Teachers* Cetner, McCulloch	**Research Session** *Supporting STEAM Practices with Digital Notebooking* Martin, Miller	**Research Session** *Discourse Analysis of South African Openly Licensed Mathematics Textbooks* Kersey	**Research Session** *Finding Common Ground: Interactions between Pre and Inservice Teachers* Watkins

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THURSDAY Morning, October 20					
	8:25-8:50	**9:00-9:50**	**10:00-10:25**	**10:35-11:00**	**11:10-11:35**
Sierra Ballroom 3	**Research Session** *Redesigning An Intermediate Algebra Course using Active Learning Techniques* Wagner-Krankel	**Hot Topic Session** *What STEM Teachers Need to Know and Do for English Language Learners* Zollman		**Research Session** *Authentic Science Research Experiences in a School-University Partnership* McCollough, Jeffery, Moore	
11:45-1:00 Lunch (Honeysuckle)					

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THURSDAY Afternoon, October 20				
	1:10-1:35	**1:45-2:35**	**2:55-3:45**	**3:55-4:20**
Suite S301B	**Research Session** *Middle School Students' Spatial Reasoning and Understanding of Matter* Cole, Wilhelm, Guido, Yates	**Research Session** *Mathematical Thinking within the Middle School Science Classroom* Horak Smith, Harmon, Wienburgh, Silva	**Hot Topic Session** *Three Act Lessons: Creative Means of Engaging Authentic Mathematical Thinking through Story Narratives* Redmond-Sanogo, Thompson, Stansberry, Vasinda	**Research Session** *Factors that Influence Planetarium Educator Pedagogy* Hartweg
Suite S302B	**Research Session** *An Integrated Approach to Math and Science Professional Development* Joy, Smeltzer	**Regular Session** *Developing Mathematical Practices in a Math Dance Class: A Case Study* Bachman, Stern, Chan	**Regular Session** *Basics of Grant Writing for Beginners* Naizer	**Research Session** *Exposing Preservice Teachers Mediation of Transnumeration between Graphical Representations* Daiga
Suite S370B	**Research Session** *Reviewing for the School Science and Mathematics Journal* *Harkness, Johnson,* Harkness, Johnson, Milner, Burton, Sondergeld	**Research Session** *Activity-based STEM Learning: What Our Research Says About "Doing is Learning"* Stuessy, Cavlazoglu, Perkins	**Regular Session** *An Introduction to Lessons Using Problem-Based Enhanced Language Learning (PBeLL)* Jimenez-Silva, Hernandez	**Research Session** *An Alternative Model for Student Teaching: Can Mentor and Student Teacher Benefit?* Watkins
Suite S371B	**Research Session** *Assessment of an Active Learning Framework in A Science Content Lecture Course* Fortney	**Research Session** *STEM Road Map: Integrated STEM Curriculum for Grades K-5* Milner, Morrison, Johnson, Walton, Sondergeld	**Research Session** *Publishing in the School Science and Mathematics Journal* Johnson, Harkness, Milner, Burton, Sondergeld	**Research Session** *The Effectiveness of Interactive Science Notebooks as a Tool for Preservice Teachers* Williams, Jay
Sierra Ballroom 1	**Research Session** *Using the Value of Integratedness Rubric to Explore Elementary Preservice Teachers' Lesson Plans* Nesmith, Cooper	**Research Session** *Algebra for All, 1901 - 2016* Balka	**Research Session** *Status of Pre-service Teachers' Understanding or Probability and Statistics* Chamberlin, Blanco-Gorham	**Research Session** *Pre-service Teachers' Promoting Students' Mathematical Discourse* Columba
Sierra Ballroom 2		**Roundtable Discussions** *A. Problem Based Learning for Urban High School Students* Powell, Salem *B, Creativity Fostered Through Project-Based Instruction* Caukin *C. A Systematic Literature Review About Evidence-Based Math Practices for K-12 English Learners* Robles, Jimenez-Silva *D. Developing a Standards-based Vertical Curriculum Alignment Across Undergraduate and Graduate Statistics* Shores, Snyder	**Regular Session** *A Comparison of Middle School Students' Science, Math, and ELA Standardized Test Scores in PBL and Traditional Programs* Kruger, Scogin	**Research Session** *STEM Road Map: Integrated STEM Curriculum for Grades 9-12* Peter-Burton, Walton, Johnson, Sondergeld

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THURSDAY Afternoon, October 20				
	1:10-1:35	**1:45-2:35**	**2:55-3:45**	**3:55-4:20**
Sierra Ballroom 3		**Roundtable Discussions** *E. Mentoring New Faculty Members and Graduate Students to Prepare Pre-service Teachers* Warren, Horak Smith, Faulkenberry, Riggs, Jackson *F. Middle School Science and Mathematics Teachers' Conceptions of Nature of Science: A Two-Year Study* Wong	**Regular Session** *Using Math Notebooks for Mathematical Investigations: Engaging Prospective Teachers in "Doing" Mathematics* Chamberlin	
4:30 – 5:20 SSMA Committee Meetings (see table below for locations) **5:30 – 6:30 General Session Honeysuckle** **6:30 – 8:00 Reception**				

Thursday Afternoon SSMA Committee Meetings 4:30 – 5:20	
Awards and Endowment	Suite 301B
Convention	Suite 302B
Finance	Suite 370B
Membership	Suite 371B
Nomination and Election	Sierra Ballroom 1
Policy	Sierra Ballroom 2
Publications	Sierra Ballroom 3

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Friday Morning, October 21				
	9:00-9:50	**10:00-10:25**	**10:35-11:00**	**11:10-11:35**
Suite S301B	**Regular Session** *Behind the Scene Factors in Designing Multimedia Anchors for PBL in Science* Kumar	**Research Session** *Simulated Virtual Classroom Teaching Experiences: A Case Study of Mathematics Preservice Teachers* Davis, Tachia, Larke	**Research Session** *Using Problem-Based Mathematics to Teach STEM* Orona	**Research Session** *A Demographic Overview of Secondary Science Education in Texas* LeBlanc, Bozeman, Stuessy
Suite S302B	**Research Session** *Supporting Students from Underrepresented Groups in Mathematics for Alternative Certification Teachers* Evans	**Research Session** *Elementary Preservice Teachers' Identification of and Plans for Children's Science Misconceptions* Hathcock, Ivey	**Research Session** *Impact of a Local Math Circle Program on Urban Middle and High-School Students* White	**Research Session** *Development of an Instrument Measuring Preservice Teachers' Self-efficacy for Educational Robotics Integration* Laubach
Suite S370B	**Regular Session** *Strategies for Inspiring and Motivating Students' Interest in STEM* Schroeder, Jackson, Mohr-Schroeder, Cavalcanti	**Research Session** *Using Dendrograms to Contrast Preservice Teachers Concepts of Mathematics and Science Teaching* Kurz	**Hot Topic Session** *Fostering Learning Through Home-School Connections- The "Home Visit"* Degand	**Research Session** *An Assessment of Middle School Mathematics Attitude* Gill
Suite S371B	**Regular Session** *Supervision in the Content Area: Case Studies for Developing Instructional Leaders* Quebec Fuentes, Bloom, Ilaria	**Research Session** *Novice Mathematics Teachers' Metacognitive Knowledge about Communicative Activities: A Case Study* Raymond	**Research Session** *Using Reflections to Explore In-service Biology Teachers' Professional Growth* Weinburgh, Silva, Horak Smith	**Research Session** *Using Drawings to Explore Beliefs about Teaching and Doing Math* Wescoatt
Sierra Ballroom 1		**Research Session** *Rethinking Next Generation Standards: Infusing Electrical Engineering Practices into a School Curriculum* Shores, Nakhmani, Lipscomb, Lingasubramanian	**Research Session** *Classroom Influences on Young African American Learners' Mathematics Identities* Roberts	**Research Session** *The Implicit VS Explicit Math in integrated STEM Activities* Maiorca, Olson
Sierra Ballroom 2		**Research Session** *Elementary Students' Understandings of Scientific Concepts and Terminology* Shepard	**Research Session** *A Dissertation Exploring the Relationship of Nature of Science and Evolution* Heaton, Angle	**Research Session** *Examining Preservice Teachers Moral Sensitivity in the Context of Socioscientific Issues* Westbrook, Breiner
Sierra Ballroom 3	**Syllabus Share** *A. Teaching Language Acquisition through STEM* Kelly *B. Let's Talk Methods for College Mathematics* Robles *C. Teaching STEM to In-service Teachers via Geology-based Field Experiences* Sinclair, Naizer, Fields, Blount	**Research Session** *Yellowstone Science for Education* Angle	**Research Session** *K-12 STEM Education: A Mobile App and Web-Based, Curricular Model* Lapp, Kumar	
12: 00-1:30 Speaker and Lunch (Honesysuckle)				

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Friday Afternoon, October 21				
	1:40-2:05	**2:15-3:05**	**3:35-4:15**	**4:25-4:50**
Suite S301B	**Research Session** *Experiences in Scholarly Faculty Member Returning to K12 Education* Koehler	**Regular Session** *Building a STEM Mindset* Staley	**Research Session** *Addressing Student Misconceptions about Diffusion and Osmosis through Direct and Inquiry Instruction* Dixon	**Research Session** *Mathematical Lessons Learned in Ethiopia and Japan* Higgins, Hargrove
Suite S302B	**Research Session** *The Interactive Nature of Rectangles in Teaching Algebra Reasoning to Preservice Teachers* Kurz		**Regular Session** *Answering the "What Works" Question: Designing Rigorous Trials of Math/Science Interventions* Spybrook	**Research Session** *Deconstructing Dinosaurs: A Proposed Learning Progression Aligned with Cross-Cutting Concepts of the NGSS* Lyons, Stuessy
Suite S370B	**Research Session** *How Preservice Teachers Plan Mathematics Lessons for English Language Learners using Technology?* Lee	**Regular Session** *Assessing Equity Among Diverse Populations -Using Area Estimation* Selitto	**Regular Session** *STEM in the Classroom: Salta, Coquí, Salta (Jump, Frog, Jump)* Columba	**Research Session** *Promising Chaos: Changes in Concept Maps of Future Elementary Math Specialists'* Conrady, Redmond-Sanogo
Suite S371B	**Research Session** *Secondary-Tertiary Transition in Mathematics: A Multifaceted Issue* Gunter	**Hot Topic Session** *The Talk: STEM Teaching Accountability vs. Reality* Jasper, Foster	**Regular Session** *Teaching Elementary Science…I Think I Can?!* McCall	**Research Session** *Effects of a Summer Program for Underserved Elementary Children on Mathematics Learning* Tuft, Bachler
Sierra Ballroom 1	**Research Session** *Structural Equation Modeling of Factors Influencing Intent to Pursue a Graduate Degree* Lunsford	**Regular Session** *History of Mathematics in the Classroom: A Focus on Cultures* Evans	**Hot Topic Session** *Building on a Classic* Saltmarsh, Chavez-Thibault, Hernandez, Rillero, Kelley, Merritt	**Research Session** *Creating a Model of Acceptance: Investigating Preservice teachers' conceptions of Latino Parents* McCollough, Ramirez
Sierra Ballroom 2	**Research Session** *Professional Development Connecting ASSURE Model for Math Teaching* Hu	**Research Session** *Two Statewide Rollout Professional Development Models for NGSS and Common Core* Cobbs, Miller	**Regular Session** *Engaging Class Openers that Enhance Students' Learning of Probability and Statistics* Che, Reeder, Utley	**Research Session** *Impacts of Educative Multi-Year Science Teacher Professional Development* Longhurst, Campbell, Wolf, Coster
Sierra Ballroom 3		**Regular Session** *Mathematics is Naturally Interesting* Emenaker	**Research Session** *Examination of Perceptual Variable Relationships from Problem-Solving Lessons in Second Life Simulation* Davis, Kulm	**Research Session** *Using Multi-Media Portfolios as Assessment* Roberts-Harris, Copeland

Canceled

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Saturday Morning, October 22				
	8:30-9:30	**9:40-10:30**	**10:40 – 11:30**	**11:40 12:30**
Suite S301B		**Research Session** *Impact of a Mathematics Content Course on PSTs Knowledge of Complex Fractions* Safak, Tobias	**Regular Session** *Elementary Mathematics Teachers' Content Knowledge: A Discussion of Two MSP Projects* Chamblee, Cobbs	**Regular Session** *Grand Challenges in Mathematics Education* Wilkerson, Clements
Suite S302B		**Regular Session** *Making a Three Dimensional Teacher* Miller, Connole, Pavlovich	**Research Session** *Measuring the Quality of Teaching with the Dynamic Geometry Software* Jiang	**Regular Session** *Building STEAM: Using Mathematics to put the A in STEM* Kinch
Suite S370B		**Research Session** *Integrating Physics with Algebra 2 in a Secondary STEM Classroom* Bowman, Bowman	**Research Session** *Developing Preservice Teachers' Understanding of Fraction Subtraction and Fraction Multiplication for Teaching* Safak	
Suite S371B		**Regular Session** *How to get from STEAM to STREAMS* Riley, Figgins	**Regular Session** *Linking Literacy: Methods of Integrating Literature in Mathematics and Science Classrooms* Cerrato Fisher	**Regular Session** *Fostering and Improving Small-Group, Student-to-Student Discourse: A Professional Development Course* Quebec Fuentes
Sierra Ballroom 1	**Innovation Showcase (See Table on next page for a list of presentations)**	**Regular Session** *Utilizing Culturally Relevant Stories in Mathematics: Research and Resources* Corp	**Research Session** *Validation of the Mathematical Modeling Knowledge Scale (MMKS) with Practicing Teachers* Asempapa	**Regular Session** *Web-based Tools to Facilitate Collaborative Experiences in Methods of Teaching STEAM Courses* Surrette
Sierra Ballroom 2		**Regular Session** *What's My Next? Exposing Students to Exciting Career Opportunities in Laboratory Medicine* Cusick	**Research Session** *University-Community Partnership: A Case of Positive Effect on STEM Undergraduate and EC-6 Students* Sen, Singh	**Regular Session** *Elementary Education Majors Develop Formative Assessments to Promote Conceptual Understanding* Cooper
Sierra Ballroom 3		**Regular Session** *Early Connections: Building Professional Networks as a Pre-Service Secondary Mathematics Teacher* Conrady	**Research Session** *What I Need: Preservice Secondary Teachers Perceptions of Their Needs* Conrady	**Research Session** *Examining Students' Understanding of Mathematical Communication* Smith, Weinburgh, Silva

SATURDAY Morning, October 22	
	8:30-9:30 a.m.
Honeysuckle	**Innovations Showcase** A. Integrating Social Studies into STEM Lessons: A Focus on English Learners: Margarita Jimenez-Silva, Karen Guerrero, Gale Ekiss B. An Issue Driven Project in AP Biology: Focus on the Seven Science Practices: Luke Lyons, Joy Killough C. Attending to STEAM in Preservice Education: Caitlin Kimmet, Ken Miller D. Graphing Skills: Pre-Service K-8 Teacher Self-Efficacy and Learning Progression: Rolando Robles, Peter Rillero E. Mathematics, Architecture, and Technology: Kelly Shepard F. Dancing and Mathing - An Integrative Approach: Erik Stern, Rachel Bachman, Julian Chan G. iPad Statistic's Apps: Amy Adkins, Lina DeVaul, Dawn Lockett, Taro Ito

Thursday Morning – Continental Breakfast (On the plaza) 7:30 – 8:15

Thursday Morning Sessions 8:25 – 8:50

#1	**Suite S301B**	**Research: Mathematics**	**#2**	**Suite S302B**	**Research: STEM**
Using Tutorial Virtual Manipulatives to Enhance Classroom Mathematical Discussion			*Research Experiences for Preservice Science Teachers*		
Katie Anderson-Pence, Jennifer Tygret			Julie Angle		
Many teachers use tutorial computer applications to address individual learning needs. But what if teachers could expand students' experience with these tutorials to create a community of mathematics learners? This session will share initial results from a study examining how teachers leverage tutorial virtual manipulatives to support students' discussion and learning of mathematics as a community. Results and videos of teachers' facilitation techniques will be presented and discussed. The results a) extend the existing literature on how teachers leverage technology in mathematics instruction, and b) suggest effective practices for engaging students in meaningful mathematics discussion through the use of technology.			Learn about a unique science pedagogy course that provides preservice science teachers (PSTs) with a semester long research experience. While this course is taught by science education faculty, research mentorships are conducted by STEM faculty across three colleges within our University. In addition to conducting *over 64 hours of authentic research, each PST develo*ps a lesson plan that is specific to their research, and constructs and presents a research poster at PST Research Symposium and Reception. This session will address the challenges of setting up such a course and also the changes in PSTs understanding of the nature of science.		
#3	**Suite S370B**	**Research: STEM**	**#4**	**Sierra Ballroom 1**	**Research: Science**
Inquiry, Projects, and Makerspaces: Bringing Math and Science to Life			*Linking Formal and Informal Science within an Undergraduate Gardening Experience*		
Martha Day, Jennifer Cribbs, Lisa Duffin,			Suzanne Nesmith, Hannah Turney, Courtney Cole, Analise Sandager		
This initiative is a Math Science Partnership grant between the SKyTeach program at Western Kentucky University and five rural school districts in Kentucky. The purpose of this project is to develop science and math teacher competencies with effective research-based inquiry teaching practices designed to increase student problem-solving skills. The presentation will focus on the project's design along with preliminary research findings. Specifically, we will highlight the teacher training models of ongoing professional development in inquiry teaching and problem-based learning, co-teaching and modeling of best practice techniques by master teachers, and professional communities of practice in developing and refining lesson plans.			The environment enables interdisciplinary, problem-based learning that can result in positive impacts on student achievement. Many consider the growth of gardens to be a notable positive trend in enhancing environmentally based experiences. Recently, there has been a surge in research associated with formal school gardens as well as informal, community-based garden projects. Whether formal or informal, an emphasis of gardening research has been the manner in which children represent science-related concepts and reason scientifically prior to, within, or outside of these settings. In this session, we will discuss the impact of formal science experiences on undergraduate students enrolled in a community gardening course.		

Thursday Morning Sessions 8:25 – 8:50

#5	**Sierra Ballroom 3**	**Research: Mathematics**

Redesigning An Intermediate Algebra Course using Active Learning Techniques

Mary Wagner-Krankel

As part of a Title V grant, the math department at St. Mary's University was asked to redesign their Intermediate Algebra course by integrating active learning techniques into the course. Intermediate Algebra was identified as one of many high-risk foundational and STEM gateway courses to be redesigned due to its high DFW rate. Changes in the content of the course, active learning techniques integrated into the course, and DFW rates for the piloted sections will be discussed. Results from traditional vs active assignments, initiatives to improve attendance, and initiatives to increase participation in tutoring services will also be highlighted.

Thursday Morning Sessions 9:00 – 9:50					
#6	**Suite S301B**	**Research: Mathematics**	**#7**	**Suite S302B**	**Research: STEM**
Mathematics' Teacher Actions: A Q methodology study			*Using the Reformed Teaching Observation Protocol (RTOP) for Novice Teachers*		
Jane Wilburne, Dana Franz, Drew Polly			Faye Bruun, Kimberly Moore		
What teaching actions, based on Principles to Actions (NCTM, 2014) do practicing mathematics teachers commonly implement? This session will engage participants in a mini version of the study that used a Q methodology to explore teachers' actions. Results of the study will be shared and time will be reserved for a productive discussion on the enactment of these teaching actions in today's classrooms.			This session provides research about the Reformed Teaching Observation Protocol (RTOP) that was used to analyze the teaching of novice educators who recently graduated from a 4-8 math and science teacher certification program. The RTOP is based on a student-centered, activity-based environment that includes multiple opportunities for collaboration. The session will include 1) Explanation of the five categories of the Reformed Teaching Observation Protocol; 2) How this tool used by mentors helps novice mathematics and science teachers become student centered; 3)Discussion of Student Centered Classroom; 4) Discussion of ways to meet demands of stakeholders while trying to implement reformed teaching practices.		
#8	**Suite S370B**	**Regular Session**	**#9**	**Suite S371B**	**Regular Session**
How are early career mathematics teachers being supported?			*Engaging Young Children and their Families in Science*		
Lisa Amick, James Martinez, Megan Taylor			Charlene Czerniak		
This study reports findings from a national survey of mathematics teachers in a teacher preparation program or in their first three years of teaching. The main objective of the survey was to gather information about how early career teachers are being supported that would inform initiatives aimed at improving teacher retention rates. The survey data focused on what types of activities teachers are participating in, their perceptions of these activities, and how the activities influenced their teaching practice. Additional questions focused on support from professional learning communities, administrators, universities, overall job satisfaction, and how long teachers plan to stay teaching.			This session will present ideas for engaging families of young children in inquiry based science. The session will provide an overview of sample Public Service Announcement videos geared for families of young children, family packs of inquiry science activities that go home from school, and materials from community events hosted at local parks, zoos, and science centers. Participants will receive sample materials to keep.		

Thursday Morning Sessions 9:00 – 9:50

#10	Sierra Ballroom 1	Regular Session
STEM Road Map: Integrated STEM Curriculum for Grades 6-8		
Janet Walton, Juliana Utley, Carla Johnson, Erin Peters Burton, Toni Sondergeld		
In this session participants will be provided an overview of the STEM Road Map project - including a brief introduction to the 6-8 integrated STEM curriculum series that will be published by the National Science Teachers Association (NSTA) in the coming year. Attendees will all receive a electronic PDF of one curriculum module of their choice.		

#11	Sierra Ballroom 2	Research: STEM
Implementation of Interdisciplinary Co-planning Teams Among Secondary Mathematics and Science Teachers		
Michelle Cetner, Allison McCulloch		
The Interdisciplinary Co-planning Team (ICT) model was developed to support teachers to communicate regularly and intentionally about the connections between mathematics and science in order to help their students build interdisciplinary connections. The model was designed to mitigate common obstacles to interdisciplinary teaching that have been identified in the research. Here we report on a case study of 4 pairs of secondary mathematics and science teachers who implemented the ICT model over the course of 8 weeks. Findings related to the co-planning process, the nature of interdisciplinary plans, and influence of the co-planning process on teacher beliefs will be discussed.		

#12	Sierra Ballroom 3	Hot Topic Session
What STEM Teachers Need to Know and Do for English Language Learners		
Alan Zollman		
A growing concern for STEM teachers is having students who do not speak English proficiently in their content area classrooms. This presentation gives a background of how STEM literacy and ELL literacy can be used productively together as well as strategies for the STEM teacher to help all students learn. Strategies for ELL literacy are good strategies for all students. Specific strategies for STEM teachers will be presented that benefit all students in developing academic language and conceptual understanding in STEM content using an experiment, "Why do I need to wear a bicycle helmet?" that incorporates Newton's laws of motion.		

Thursday Morning Sessions 10:00 –10:25

#13	Suite S301B	Research: STEM	#14	Suite S302B	Research: STEM
Elementary Teachers' Perceptions of Engineering, Engineering Education, and Barriers to Teaching Engineering			*Activity-based STEM learning: What our research says about "doing is learning"*		
Rebekah Hammack, Toni Ivey			Muhammet Akif Ayhan, Yusuf , Ali Bozkurt		
The Next Generation Science Standards require that elementary teachers incorporate engineering practices into their science teaching. However, little research exists that describes elementary teachers' perceptions of the nature of engineering and K-5 engineering education or the barriers associated with teaching engineering at the elementary level. This explanatory sequential mixed methods study describes findings from a state-wide survey of Oklahoma in-service elementary teachers and describes their current perceptions of engineering, K-5 engineering education, and barriers to teaching engineering at the K-5 level.			The purpose here is to investigate middle school mathematics teachers' attending to classroom events, interpreting students' thinking and deciding how to respond on the basis of this knowledge. Thirty mathematics teachers analyzed a video excerpt with two different middle school students' solutions of a geometry problem. In order to explore their level of noticing skills, the participants were asked to respond to three open-ended questions. Also a whole group video discussion was conducted and video recorded. Analysis of participants' written responses and group discussion suggest that teachers provide little evidence of interpreting students' thinking and deciding how to respond.		
#15	**Suite S370B**	**Research: Science**	**#16**	**Suite S371B**	**Research: STEM**
Discerning Science from Non-science: Pre-service Elementary Teachers Consider Alternative Explanations to Evolution			*Living on the EDGE: Lessons Learned from Project-Based Engineering Education*		
Mark Bloom, Ian Binns			Cindy Alexander, Lezlie Gruenler, Stephen C. Scogin		
Evolution remains a highly controversial topic in science education. This study explores how 76 preservice elementary teachers (PSTs) justify including or excluding creationism and intelligent design (ID) in the science curriculum. Data came from an activity, which proposed that a local school board is considering a motion to include creationism and ID in the curriculum; PSTs provided their recommendations. Data, coded using an inductive, constant comparative approach, revealed 32 would not add creationism or ID, 26 would add both, 9 would add creationism, 6 would add ID, and 3 would mention them. Rationales for the PSTs' decisions will be explored.			EDGE is a design project imbedded in a first-year college engineering course. Students work with instructors to engineer products to meet specific customer needs. Researchers analyzed 84 student reflections using grounded theory and developed a conceptual model to explain how EDGE informed students' understanding of the design process and their perceptions of the engineering field. Evidence suggests this project-based learning (PBL) experience successfully engaged students and led to greater appreciation for engineering. As NGSS brings new focus to the design process, this study informs future K-16 efforts to structure PBL courses that motivate students with authentic engineering practices.		

Canceled

Thursday Morning Sessions 10:00 – 10:25					
#17	**Sierra Ballroom 1**	**Research: Mathematics**	**#18**	**Sierra Ballroom 2**	**Research: STEM**
Preservice teachers' knowledge of solving problems in different ways using decimal operations			*Supporting STEAM Practices with Digital Notebooking*		
Eunmi Joung			Christie Martin, Bridget Miller		
The purpose of the current study is to determine preservice teachers' ways of finding solutions to problems using decimal operations and investigating the types of strategies preservice teachers use. Numerous research studies have increasingly shown that learning using multiple solution methods can enhance mathematics understanding and obtain higher order thinking skills. The results show that preservice teachers have already possessed the strategies needed to solve decimal problems in multiple ways and demonstrated more variety in solving problems in the following order: Subtraction, Addition, Multiplication, and Division. The direction of future research about implementing multiple solutions will be discussed.			The researchers examined the use of digital note-booking in a diverse elementary school population. *Digital* note-booking was employed in this study addressing the 5E learning cycle and connection to standards across curriculum (Bybee, 2014). Calkins (1986) workshop model noted several fluid components of the writing process that were also evident in the use of this tool. The technology provided voice recording, images, ease of collaboration, and the ability to integrate multimedia literacy technologies. The findings suggested that students engaged in meaning making in multiple ways, captured moments were reviewed for deeper understanding, and the writing process components were integrated.		

Thursday Morning Sessions 10:35 – 11:00					
#19	**Suite S301B**	**Research: Science**	**#20**	**Suite S302B**	**Research: STEM**
Chemistry Teachers Learn How To POGIL			*Professional Development Schools Partnerships—Beyond Internships and Field Experiences*		
Nancy Caukin			Susan Cooper		
With the goal of improving teacher content knowledge and PCK, professors from the Colleges of Education, Basic and Applied Sciences, and the STEM center collaborated to provide chemistry teachers a 5-day workshop engaging them in the teaching *strategy* POGIL (process oriented guided inquiry learning). Funded by a Tennessee Improving Teacher Quality (ITQ) grant, teachers from four high needs districts and from the surrounding area participated in this professional development experience. They took a pre and post content knowledge test, as well as the Instructors' Attitudes towards Active Learning Survey (Kinneret & Herscovitz, 2009). Results will be shared.			When a formal Professional Development School (PDS) partnership was established between our College of Education and two diverse rural school districts, short-range *goals* needed to be developed to re-establish collaboration based on meaningful relationships between P-12 teachers and the College. I will discuss the challenges of creating a university presence focused on application of research-based STEM education practices to improve overall P-12 student achievement while involving our education majors in developing their teaching skills. I will also provide examples of the professional learning opportunities that were developed to support teachers as we worked to enhance student achievement.		
#21	**Suite S370B**	**Research: Mathematics**	**#22**	**Suite S371B**	**Research: STEM**
Norming the Chamberlin Affective Instrument for Mathematical Problem Solving			*Using a PBL Approach to Foster More Positive Student Attitudes in STEM*		
Scott Chamberlin, Alan Moore, Kelly Parks			Stephen Scogin, Christopher Kruger, Regan E. Jekkals		
Details of an instrument (CAIMPS) that was designed to assess students' affect (feelings, emotions, and dispositions) during mathematical problem solving scenarios are discussed in relation to its use in the classroom. The 'free for public use' *instrument* has properties which enable it to be used by teachers with confidence and interpret results easily. In the era of Common Core Standards, it is vital we understand students' mathematical thinking. According to research, affect is a critical piece in students' mathematical success and using this instrument will enable teachers to make curricular and instructional decisions based on empirical data, rather than guesswork.			In response to decreasing numbers of students choosing STEM fields, some schools are implementing project-based learning (PBL) to foster better student attitudes and increase student *motivation*. In this study, researchers analyzed student interview data to determine student perspectives on the transition from a traditional STEM pedagogy to a PBL pedagogy in a Midwestern middle school. In addition, researchers used survey and interview data to investigate changes in student confidence and efficacy in STEM subjects, 21st century learning skills, and interest in STEM careers. Preliminary results indicate the use of PBL positively contributes to student attitudes about STEM.		

Thursday Morning Sessions 10:35 – 11:00

#23	**Sierra Ballroom 1**	**Research: Science**
Analysis of Larger Mediums for Mental Models of Science and Science Teaching		
Jenny Peters, Stephanie Hathcock		
People's perceptions of scientists and science teaching are often measured using mental model tests such as the Draw-A-Scientist-Test and Draw-A-Science-Teacher-Test. Results generally showcase stereotypical images of scientists and teacher-directed images of science teaching. This research questions the traditional structure for these drawings by showcasing differences in preservice teachers' mental models when presented with the typical 8.5"x11" paper to draw on and an 11"x14" paper. Differences in the characteristics and detail provided in each size drawings will be presented along with a discussion of how these relate to the perceptions students hold about science and science teaching.		

#24	**Sierra Ballroom 2**	**Research: Mathematics**
Discourse Analysis of South African Openly Licensed Mathematics Textbooks		
Elizabeth Kersey		
South African curriculum reform efforts have *focused* on making education more equitable. One way to measure this goal is to examine the voice of a curriculum. Thus, I use a discourse analytic framework to evaluate selected chapters from the Grade 12 Mathematics textbook from Free High School Science Texts and Everything Maths for Grade 12. The latter text grew out of the former, so I focus on how the text has evolved. The newer version provides more access into the standard language of academic mathematics, but is less consistent with the ontology of mathematics in South African national curriculum documents.		

#25	**Sierra Ballroom 3**	**Research: Science**
Authentic Science Research Experiences in a School-University Partnership		
Cherie McCollough, Tonya Jeffery, Kim Moore		
This presentation outlines an innovative school-university partnership that builds on a rich history of collaboration and shared commitment to STEM excellence between Texas A&M University – Corpus Christi (TAMUCC) and Corpus Christi Independent School District (CCISD). The project involves an authentic summer research experience between pre- and inservice CCISD 4-8 mathematics and science teachers and TAMUCC university research faculty. Highlights of the Math-Science Partnership program and details regarding summer authentic science explorations including qualitative and quantitative findings will be presented.		

Thursday Morning Sessions 11:10 – 11:35					
#26	**Suite S301B**	**Research: STEM**	**#27**	**Suite S302B**	**Research: Science**
iTeach ELLs: Efforts in Closing the Achievement Gap			*Perceived Impacts of a Research Experience for Undergraduate Chemistry Majors*		
Michael Kelley, Wendy Farr,			Adriana Lunsford		
In this session participants will expand their knowledge regarding the need and the efforts surrounding a college wide curriculum reform toward preparing pre-service teachers to work with English Language Learners (ELLs). This work focuses on science and math methods coursework within the elementary education program at a large public university.			The scope of this case study involved investigating students' experiences in the NSF-REU Program to probe the impacts of participating in such an undergraduate research experience on their laboratory skills and their desired career path. Participants were individuals engaged in the University's NSF-REU Program during their undergraduate degree and who returned to the University for their graduate studies. After synthesizing the data gathered in the interviews, the following four themes emerged: characteristics of building a "successful" undergraduate research experience, importance of mentors and group collaborative dynamics, improving laboratory skills through research, and seeing that graduate school is a possible goal		
#28	**Suite S370B**	**Research: Mathematics**	**#29**	**Suite S371B**	**Research: Mathematics**
Characterizing Middle School Students' Experiences in a Project-Based Learning Program			*Formal and informal proofs in secondary geometry*		
Regan Jekkals, Stephen C. Scogin, Christopher J. Kruger			Oscar Chavez, Ruthmae Sears		
In part as a response to waning student motivation, STREAM School was created to combine science, technology, reading, engineering, art, and mathematics in a project-based format with an emphasis on outdoor education. Using mixed methods and data from surveys, interviews, and observations, researchers used self-determination theory to explain why: (a) some students were intrinsically motivated by the program, (b) some students enjoyed projects while others were less motivated by the same project, (c) greater perceived choice in completing projects led to more satisfaction, and (d) some students recognized the future usefulness of a given project but remained unmotivated.			We examined students' responses to items involving proofs in geometry. One was designed to elicit an informal argument, for first year high school students; the second was for students in the third year of high school. These results are part of a longitudinal study in U.S. high schools where students could choose between two types of curriculum, an integrated approach or a subject-specific approach. We found that, regardless of curriculum, students experience difficulty with proofs and that students were more likely to provide correct informal arguments than they were likely to write formal proofs after formal instruction in geometry.		

Thursday Morning Sessions 11:10 – 11:35					
#30	**Sierra Ballroom 1**	**Research: Science**	**#31**	**Sierra Ballroom 2**	**Research: Science**
Science Autobiographies: Examining Pre-service Elementary Teachers' Attitudes Towards Science			*Finding Common Ground: Interactions between Pre and Inservice Teachers*		
Erin Pearce, Morgan Stewart			Kathryn Watkins		
Elementary teachers' attitudes towards science correlates to the quality and quantity of science taught in classrooms (Schoeneberger & Russel, 1986; Wallace & Louden, 1992). In this study, pre-service elementary teachers composed science autobiographies depicting their current and past science experiences. The researchers coded for themes throughout the autobiographies to better understand how past experiences affect attitudes toward science at the post-secondary level. This session will discuss the results and implications of the themes. In addition, we will also discuss how to better science experiences for primary and secondary students.			Pre-service and inservice teachers do not traditionally take university classes together. Yet inservice teachers would and should have a great deal of practical and privileged knowledge to contribute to the development of preservice teachers and perhaps the reverse exists. What kinds of communications, interactions and relationships could develop between inservice and preservice when engaged in a course together? Both groups of teachers will be taking a class identified as seminar in science teaching. Data on communication formats, observations of interactions and personal descriptions of relationships will be collected and analyzed.		

Thursday Lunch (Honeysuckle) 11:45-1:00

Thursday Afternoon Sessions 1:10 – 1:35					
#32	**Suite S301B**	**Research: Science**	**#33**	**Suite S302B**	**Research: STEM**
Middle School Students' Spatial Reasoning and Understanding of Matter			*An Integrated Approach to Math and Science Professional Development*		
Merryn Cole, Jennifer Wilhelm, Brittany Guido, Dakota Yates			Killough Joy, Penny Smeltzer		
This study examines the correlation between sixth-grade students' spatial reasoning ability and their understanding of the particulate nature of matter. The NGSS bring the particulate nature of matter to the forefront in the 6-8 grade band, where the emphasis is placed on understanding matter and its interactions at the particulate level. Research with college students has shown a correlation between understanding of chemistry content and spatial reasoning ability (e.g., Pribyl & Bodner, 1987; Wu & Shah, 2003: Stieff, 2013). We found a significant positive correlation between middle level students' spatial reasoning and their understanding of the particulate nature of matter.			AP Biology curriculum reforms effective in 2013 significantly increased the role of mathematics in the program (The College Board, 2013). Science and math integration increases the relevance of both subjects but teaching through an integrated approach has some challenges particularly in finding appropriate lessons. This session will describe an integrated professional development approach in AP Biology and AP Statistics through a model lesson.		
#34	**Suite S370B**	**Research: STEM**	**#35**	**Suite S371B**	**Research: STEM**
Reviewing for the School Science and Mathematics Journal			*Assessment of an Active Learning Framework in A Science Content Lecture Course*		
Shelly Harkness, Carla Johnson, Andrea Milner, Erin Peters Burton, Toni Sondergeld			Brian Fortney		
In this session participants will learn the process of applying to become a reviewer for the School Science and Mathematics journal. We will discuss the review criteria for manuscripts and tips for providing high-quality reviews.			This investigation assessed the understanding of EC-6 and 4-8 certification pre-service teachers (PSTs) attending a mid-sized university in South-Central Texas concerning fundamental physics concepts regarding Newtonian Mechanics. A Force Concept Inventory (FCI) was administered in addition to other measures. Of interest was the intersection between mathematics and science. Data on the topic of balance and equivalence indicated approximately 85% of all PSTs defined "=" as equal, and not "equivalent." After 6-weeks of hands-on, active instruction on Newtonian Mechanics, 98% of PSTs scored well on the Balance and Equivalence post-test. However fewer of the PSTs indicated understanding on the FCI.		

Thursday Afternoon Sessions 1:10 – 1:35

#36	Sierra Ballroom 1	Research: STEM

Using the Value of Integratedness Rubric to Explore Elementary Preservice Teachers' Lesson Plans

Suzanne Nesmith, Sandi Cooper

The integration of mathematics and science in the elementary grades seems natural and manageable. However, it requires an understanding of integration and a desire to embrace the process in order for it to occur effectively. Elementary preservice teachers concurrently enrolled in elementary mathematics and science methods courses and an elementary field experience were required to develop and share mathematics/science integrated lessons. In this session, we will share specifics of the assignment and discuss the preservice teachers' levels of integration as revealed by the application of the Value of Integratedness Rubric (Laubach, Neill, & Patrick) to their mathematics/science integration lesson plans.

Thursday Afternoon Sessions 1:45 – 2:35					
#37	**Suite S301B**	**Research: STEM**	**#38**	**Suite S302B**	**Regular Session**
Mathematical thinking within the middle school science classroom			*Developing Mathematical Practices in a Math Dance Class: A Case Study*		
Kathy Horak Smith, Matthew Harmon, Molly Weinburgh, Cecilia Silva			Rachel Bachman, Erik Stern, Julian Chan		
Two of the practices of science outlined in the Next Generation Science Standards (NGSS) are analyzing and interpreting data and using mathematics and computational thinking. As teachers, how can we be sure our students are developing these skills within the science classroom? Lemke's notions (2002, 2004) regarding communication within the mathematics and science classrooms will be discussed as the theoretical background for identifying these practices within students' work. Examples of student work will be shared and participants will be given time to analyze some of these samples.			This qualitative case study investigates an integrated general education course exploring mathematical concepts through the use of dance and other physical motion activities. The case study focuses on the classroom practices used to engage students in the development of the eight standards of mathematical practices outlined in the CCSS-M. The session will include integrative demonstrations of some of the methods used in the course and a report of the differences in the use of mathematical practices during recorded problem-solving interview with students from the math dance course and students from a traditional mathematics class.		
#39	**Suite S370B**	**Research: STEM**	**#40**	**Suite S371B**	**Research: STEM**
Activity-based STEM learning: What our research says about "doing is learning"			*STEM Road Map: Integrated STEM Curriculum for Grades K-5*		
Carol Stuessy, Baki Cavlazoglu, Abby Perkins			Andrea Milner, Vanessa Morrison, Carla Johnson, Janet Walton, Toni Sondergeld		
Can teachers convincingly argue that doing is learning without evidence from paper-and-pencil test results? We designed Earthquake, a board game for STEM middle-grade learners. The game required learners to act as city council members who create and sustain a city located on a fault zone. Collaborative groups competed against other groups to create urban infrastructures "protecting" their inhabitants from random earthquakes occurring with the draw of a card. Research using activity-based, authentic measures (i.e., concept maps and dialogue analysis) confirmed that playing the game constituted learning, thus supporting prevailing arguments that doing can be learning in activity-based STEM learning environments.			In this session participants will be provided an overview of the STEM Road Map project - including a brief introduction to the K-5 integrated STEM curriculum series that will be published by the National Science Teachers Association (NSTA) in the coming year. Attendees will all receive a electronic PDF of one curriculum module of their choice.		

Thursday Afternoon Sessions 1:45 – 2:35

#41	**Sierra Ballroom 1**	**Research: Mathematics**
Algebra for All, 1901 - 2016		
Don Balka		
SSMA has been publishing its journal since 1901. Many articles have focused on algebra curricula, algebraic reasoning, the history of algebra, and various oddities useful in today's classroom. See what you missed and hear some quotes that still resonate with mathematics teachers in 2016.		

Thursday Afternoon Sessions 1:45 – 2:35

#42	Sierra Ballroom 2, 3	Roundtable Discussions

Problem Based Learning for Urban High School Students
Angiline Powell, Wesam Salem

STEM Camp for Urban High school students. The presentation will examine the development and refinement of a water-based Problem Based Learning (PBL) for high school students. The original problem was centered on an interruption of the local drinking water source, and students were asked to come up with an alternative water source from surrounding rivers. Since the implementation of the original PBL, the topic of alternative water sources has been in the national news. In this session we will compare and contrast student solutions from first year to second year as well as the challenges and promises of infusing mathematics, technology and environmental science.

Creativity Fostered Through Project-Based Instruction
Nancy Caukin

Learning-by-doing is well documented in the literature. Project-based instruction (PBI) starts with an interesting and relevant driving question. It allows students to make choices about how to go about answering that question. It also engages them in asking more questions and seeking out answers by doing research and engaging with their teacher/facilitator in "just-in-time" teaching. Preservice math and science teachers learn about PBI and implement a week long learning segment engaging students in PBI. This process not only scaffolds preservice teachers' learning about PBI, through this process, they also employ creativity and problem solving.

A Systematic Literature Review About Evidence-Based Math Practices for K-12 English Learners
Robert Robles , Margarita Jimenez-Silva,

Too often the term "evidence-based" practice is used without any systemic definition of what the term means. Applying the stringent standards used by the Council for Exceptional Children to determine what counts as an "evidence-based" practice, we reviewed the existing literature on pedagogical practices for K-12 English learners when developing mathematical understanding. In this session, the presenters will discuss the methodology for conducting such a literature review from an initial query that included over 1,700 studies. Findings and recommendations for those interested in improving the mathematical learning opportunities for English learners will be shared.

Developing a Standards-Based Vertical Curriculum Alignment across Undergraduate and Graduate Statistics
Melanie Shores, Scott Snyder

Developing a horizontal/vertical curriculum alignment between undergraduate and graduate statistics is crucial to the success of students as they progress through their statistics sequence. By identifying common content standard strands that can be applied across undergraduate/graduate level statistics courses, the authors are able to vertically link curricular expectations and assessments across the courses. Our goals are: (a) to identify and address academic gaps, redundancies, and misalignments for purposes of improving the overall coherence for our current statistical course sequence, (b) improve the clarity of the curriculum goals for students and other faculty, and (c) improve the effectiveness of the courses.

Thursday Afternoon Sessions 1:45 – 2:35

#43	**Sierra Ballroom 2, 3**	**Roundtable Discussions**

Mentoring New Faculty Members and Graduate Students to Prepare Pre-Service Teachers
Michael Warren, Kathy Horak Smith, Eileen Faulkenberry, Beth Riggs, Rose Ann Jackson

We will discuss the experiences of mentor faculty and new faculty/graduate students within the context of the mathematics education classroom. How do experienced faculty mentor new faculty/graduate students to teach, work with, and assess pre-service teachers? How can mentors encourage new faculty/graduate students to push beyond content knowledge teaching? Within the context of problem solving, we look at past examples of student work in order to inform faculty/graduate students' first teaching experience. This allows a new faculty member to design their course with some understanding of how pre-service students think.

Middle School Science and Mathematics Teachers' Conceptions of Nature of Science: A Two-Year Study
Sissy Wong

This research study examined the nature of science (NOS) knowledge of middle school science and mathematics teachers (N=19) during a two-year integrated online master's program. Findings showed statistically significant changes after one year of explicit and reflective NOS instruction. An additional year of explicit and reflective instruction did not result in statistically significant changes. The investigation of practicing middle school science and math teachers' NOS conceptions is important for researchers and teacher educators to gain insight into how to foster, develop, and sustain sophisticated NOS views of preservice and practicing science and mathematics teachers.

Thursday Afternoon Drink Break (On the Plaza) 2:35 – 2:55

Thursday Afternoon Sessions 2:55 – 3:45					
#44	**Suite S301B**	**Hot Topic Session**	**#45**	**Suite S302B**	**Regular Session**
Three Act Lessons: Creative Means of Engaging Authentic Mathematical Thinking through Story Narratives			*Basics of Grant Writing for Beginners*		
Adrienne Redmond-Sanogo, Penny Thompson, Susan Stansberry, Sheri Vasinda,			Gil Naizer		
Three-Act tasks provide opportunities for P-12 learners to engage in creative problem posing, exploration, and mathematical discussion through video storytelling. Because they are innovative and relatively new, preservice and inservice teachers may not be familiar with evaluating, creating, and implementing Three-Act Tasks. In this chapter we describe our design process for developing a rubric to evaluate and scaffold these creative multimedia mathematical stories. The rubric draws on three broad areas of literature for its theoretical grounding: (1) research on high cognitive demand tasks, (2) research on assessing and measuring creativity, and (3) principles of effective multimedia message design.			Basics of the grant writing process and tips for successful grants will be presented by experienced grant writers. The audience will have the opportunity to brainstorm their ideas for funded research and identify potential funding sources.		
#46	**Suite S370B**	**Regular Session**	**#47**	**Suite S371B**	**Research: STEM**
An Introduction to Lessons Using Problem-Based Enhanced Language Learning (PBeLL)			*Publishing in the School Science and Mathematics Journal*		
Margarita Jimenez-Silva, Jaclyn Hernandez			Carla Johnson, Shelly Harnkess, Andrea Milner, Erin Peters Burton, Toni Sondergeld		
Problem-Based Enhanced Language Learning is a teaching approach that holds promise for meeting the academic and linguistic needs of English Learners while also developing the content language of all students. In this session, we will provide the research-base for this approach as well as a sample lesson that was developed to use as a model in secondary science methods courses. Students in our teacher education program are asked to create a PBeLL experience in a number of their courses and rubrics for assessing their lessons will be shared. In addition, pre-service teachers' perspectives on using this approach will be presented.			This session will provide an overview of the requirements for publishing in the School Science and Mathematics Journal. We will discuss tips for success in the submission and review process. Anyone considering submitting a manuscript that has not published in the journal before are strongly encouraged to attend.		

Thursday Afternoon Sessions 2:55 – 3:45

#48	Sierra Ballroom 1	Research: Mathematics
Status of Pre-Service Teachers' Understanding or Probability and Statistics		
Scott Chamberlin, Tracey Blanco-Gorham		
Data from the Statistical Reasoning Assessment (Garfield, 2003), an assessment designed to identify teacher conceptions and misconceptions in probability and statistics, are presented. Various concepts such as reasoning about data, representations, statistical measures, uncertainty, samples and populations, and association are discussed. Data shows that elementary pre-service teachers in the intermountain region have poor understanding of combinatorics, sampling variability, average, and 2 way table interpretation and stronger than expected conceptual understanding of independence, interpreting stated probabilities, and representativeness. Along with the data, implications for teacher preparation and professional development are provided.		

#49	Sierra Ballroom 2	Regular Session
A Comparison of Middle School Students' Science, Math, and ELA Standardized Test Scores in PBL and Traditional Programs		
Christopher Kruger, Stephen C. Scogin		
Project-based learning (PBL) is an evolving pedagogical approach in which students gain knowledge and skills by investigating complex questions. However, some schools are reluctant to incorporate PBL on a large scale due to uneasiness about the effects on standardized test scores. In this quantitative study, researchers used district, state, and national-level math/science/ELA standardized test scores to compare students in traditional instruction to students in an extended PBL program at the same rural middle school in the Midwest. The results of this study contribute to ongoing conversations about the effectiveness of the PBL instructional method in a standardized testing culture.		

#50	Sierra Ballroom 3	Regular Session
Using Math Notebooks for Mathematical Investigations: Engaging Prospective Teachers in "Doing" Mathematics		
Michelle Chamberlin		
Too often, students are merely consumers of mathematics, without many opportunities to engage in authentic processes of doing mathematics. Math notebooks, in which students document their processes while working on mathematical problems, serve as one means to address this dilemma. In this presentation, I describe the use of math notebooks for 'low-threshold, high-ceiling' mathematical investigations in my undergraduate mathematics class for elementary education majors. Details about the implementation as well as resulting impacts will be shared, including how the notebooks extended the prospective teachers' understandings of how mathematics is 'done' and their conceptions of how to teach mathematics.		

Thursday Afternoon Sessions 3:55 – 4:20					
#51	**Suite S301B**	**Research: Science**	**#52**	**Suite S302B**	**Research: Mathematics**
Factors that Influence Planetarium Educator Pedagogy			*Exposing Preservice Teachers Mediation of Transnumeration between Graphical Representations*		
Beau Hartweg			Michael Daiga		
The recent exponential growth in planetarium systems combined with a paradigm shift in science centers presents a great opportunity to educate students about astronomy, but it also presents a challenge to planetarium educators to provide quality educational experiences within the planetarium setting. A qualitative study was conducted exploring the ways planetarium educators at an informal science center use a portable planetarium to teach astronomy programs in schools, and the factors that influence their pedagogy. Data collection included interviews with 3 planetarium educators, and observations of planetarium programs. Data was analyzed using discourse analysis and categorical aggregation. Results will be presented.			Statistics education continues to develop into a pivotal role for society, particularly with the growth of available data sources (Franklin et al., 2007). The following research study attempts to quantify preservice teachers' Statistical Knowledge for Teaching (SKT) with regards to their knowledge of transnumeration. Transnumeration is the idea that different statistical concepts can emerge from the same data set when represented through different graphical representations. AP-Stats and NAEP items were used as a platform to write tasks that preservice teachers' completed and discussed in semi-structure interviews. Preliminary findings suggest preservice teachers have adequate content knowledge, but lack statistical pedagogical knowledge.		
#53	**Suite S370B**	**Research: STEM**	**#54**	**Suite S371B**	**Research: Science**
An Alternative Model for Student Teaching: Can mentor and Student Teacher Benefit?			*The Effectiveness of Interactive Science Notebooks as a Tool for Preservice Teachers*		
Kathryn Watkins			Lynda Williams, Sandy Jay		
Student teachers and teachers engage with teacher educators to develop a model of clinical experience based on engagement in science classes in a diverse school district. A teacher educator from a Southwestern Research 1 University engages with the teachers in science and mathematics. The teacher educator participates in professional learning communities (PLC's) with teachers and student teachers to explore the teaching and learning of diverse cultural and language students. School based teachers, teacher educator and student teachers will engage in inquiry into teaching unique populations along with effective teaching practices and developing cultural competency of techers.			This study examines whether pre-service teachers will use interactive notebooks beyond their science methods course. Does the use of interactive notebooks with pre-service teachers in a science methods course influence later use of the tool in those teachers' elementary classrooms? The first phase of the study involved contacting former pre-service teachers to identify if they were using interactive notebooks and to justify the importance of interactive notebooks in the classroom as well as benefits to their students or lack of importance of this tool in their classroom. The second phase involved interviewing a sample of students to determine the influence interactive notebooks played in their classrooms. The findings show the majority of former students surveyed were using interactive notebooks, a large percent have shared this tool with colleagues, and most feel this tool was effective in their teacher preparation class. The implications are this tool is being realized outside the college science methods course and is also impacting elementary students in a positive way.		

Thursday Afternoon Sessions 3:55 – 4:20					
#55	**Sierra Ballroom 1**	**Research: Mathematics**	**#56**	**Sierra Ballroom 2**	**Research: STEM**
Pre-service Teachers' Promoting Students' Mathematical Discourse			*STEM* Road Map: Integrated STEM Curriculum for Grades 9-12		
Lynn Columba			Erin Peters-Burton, Janet Walton, Carla Johnson, Toni Sondergeld		
Participants will be able to describe how pre-service elementary education teachers define mathematical discourse pre- and post- an elementary mathematics methods course. How novice teachers describe the implementation of mathematical discourse in their teaching, which can be difficult to manage and implement, will be discussed. My research uses the following definition of discourse: an interactive and sustained discourse of a dialogic nature between teachers and students aligned to the content of the lesson that addresses specific student learning issues (Piccolo, Harbaugh, Carter, Capraro, & Capraro, 2008, p. 378).			In this session participants will be provided an overview of the STEM Road Map project - including a brief introduction to the 9-12 integrated STEM curriculum series that will be published by the National Science Teachers Association (NSTA) in the coming year. Attendees will all receive an electronic PDF of one curriculum module of their choice.		

Thursday Afternoon SSMA Committee Meetings 4:30 – 5:20	
Awards and Endowment	Suite 301B
Convention	Suite 302B
Finance	Suite 370B
Membership	Suite 371B
Nomination and Election	Sierra Ballroom 1
Policy	Sierra Ballroom 2
Publications	Sierra Ballroom 3

Thursday General Session 5:30-6:30 (Honeysuckle)

Keynote Speaker

Richard K. Lawrence
Program Manager
Arizona Game and Fish Department

You Want to Map What?
Arizona Game and Fish Department's Experience with Implementing GIS

Dr. Richard K. Lawrence has served as the GIS Program Manager for Arizona Game and Fish Department since 2014, relocating from Southern California where, during the previous 17 years, he worked as a Senior Conservation GIS Consultant for the world's market share GIS leader, Environmental Systems Research Institute (ESRI). Richard's GIS duties at Arizona Game and Fish Department include managing a GIS analyst team and the GIS software infrastructure for the Department. At ESRI, Dr. Lawrence managed GIS, database, and internet development projects, primarily in the areas of environment, health, and natural resources.

Dr. Lawrence also taught GIS, business strategy, and conservation coursework as an Adjunct Professor for the University of Redlands School of Business during 1997-2014. He received his Ph.D. in wildlife science in 1995 from Texas Tech University (TTU) and a two-year post doc at the State University of New York in Syracuse. Richard earned his M.S in wildlife biology in 1990 from Iowa State University and his B.S. in wildlife management in 1986 from Texas Tech University. Dr. Lawrence and his wife, Pam, make their home in El Mirage, AZ. Dr. Lawrence also enjoys hobbies of scuba diving, fly fishing, and hiking.

Reception and Cash Bar (Honeysuckle) 6:30 – 8:00

Friday Morning Sessions 9:00-9:50					
#57	**Suite S301B**	**Regular Session**	**#58**	**Suite S302B**	**Research: Mathematics**
Behind the Scene Factors in Designing Multimedia Anchors for PBL in Science			*Supporting Students from Underrepresented Groups in Mathematics for Alternative Certification Teachers*		
David Kumar			Brian Evans		
In this presentation, factors behind the scene regarding the development of multimedia anchors for problem based learning in science will be analyzed and discussed. Efforts to create multimedia anchors are demanding in factors such as human resources, material resources, technology resources, financial resources and time. The pedagogical impact of the end product depends on these factors and how they are properly integrated with established theories of learning, principles of teaching and goals of science education. The analysis and discussion will center on the lifecycle experiences derived from a funded problem-based learning in nanotechnology project.			It is important for new teachers in alternative certification programs to ensure all of their students receive quality education, particularly in mathematics. Mathematics is a gatekeeper subject in which strong quantitative skills lead to increased opportunities. This presentation addresses support new alternative certification teachers need as well as the support they could provide to students in diverse mathematics classrooms. New teachers were surveyed to determine their attitude toward student learning in diverse classroom environments in mathematics education. Teachers indicated highest agreement with the idea that students from underrepresented groups are just as capable of engaging in higher level mathematics.		
#59	**Suite S370B**	**Regular Session**	**#60**	**Suite S371B**	**Regular Session**
Strategies for inspiring and motivating students' interest in STEM			*Supervision in the Content Area: Case Studies for Developing Instructional Leaders*		
Craig Schroeder, Christa Jackson, Margaret J. Mohr-Schroeder, Maureen Cavalcanti			Sarah Quebec Fuentes, Mark Bloom, Daniel R. Ilaria		
Research has shown that more exposure to a variety of STEM opportunities will have a long-term effect on individuals and the overall STEM education community (Wai, Lubinski, Benbow, & Steiger, 2010). In this session, we will discuss and immerse participants in strategies for inspiring and motivating students' perceptions and interest in STEM. Participants will also get the opportunity to use 3D pens for modeling!			Even well-prepared educational leaders find themselves supervising teachers in grades and/or content areas in which they lack experience. To fill such gaps, this session explores the use of case studies in elementary, middle, and high school mathematics and science instruction to support the development of K-12 instructional leaders. The cases incorporate preliminary activities, narratives, discussion questions, suggested activities and supplementary resources, and case facilitation notes. Intentional use of these cases will expose developing school leaders to the nuances that distinguish mathematics and science instruction from other content areas and better prepare leaders to support teachers in these subjects.		

Friday Morning Sessions 10:00 – 10:25					
#62	**Suite S301B**	**Research: Mathematics**	**#63**	**Suite S302B**	**Research: Science**
Simulated Virtual Classroom Teaching Experiences: A Case Study of Mathematics Preservice Teachers			*Elementary Preservice Teachers' Identification of and Plans for Children's Science Misconceptions*		
Trina Davis, Gloria Tachia, Patricia Larke			Stephanie Hathcock, Toni Ivey		
A key component of the Knowledge for Algebra Teaching for Equity Project focuses on preservice teachers (PSTs) designing and teaching culturally relevant problem-solving lessons in a simulated virtual classroom in Second Life. Results from a case study of eight PSTs will be presented. Qualitative methods were used to understand teaching approaches and perspectives of PSTs and to bring meaning to their experiences through description and analysis of their perceptions. Transcripts of their lesson recordings were examined and a constant comparative method was used to uncover emergent themes and develop meaningful accounts of instructional practices, engagement, experiences, perceptions, and teaching reflections.			This session will focus on the application of preservice teachers' content and pedagogical knowledge as they attempt to correctly identify and respond to 1st – 8th grade students' science misconceptions. After building content and pedagogical knowledge about seasons and moon phases, preservice teachers interviewed students regarding their knowledge about these topics. They then used their content knowledge to identify students' correct and incorrect conceptions. Based on this, they applied their pedagogical knowledge to determine a plan for building upon student knowledge grounded in the standards associated with students' current grade level and best practices for teaching these concepts.		
#64	**Suite S370B**	**Research: STEM**	**#65**	**Suite S371B**	**Research: Mathematics**
Using Dendrograms to Contrast Preservice Teachers Concepts of Mathematics and Science Teaching			*Novice Mathematics Teachers' Metacognitive Knowledge about Communicative Activities: A Case Study*		
Terri Kurz			Kate Raymond		
Using Personal Construct Theory, 24 STEM preservice elementary teachers were asked to use pairwise comparisons to contrast different subject areas (mathematics, science, STEM, language arts and interdisciplinary learning). Using their comparisons, a repertory grid was created and administered. Dendrograms were then generated using Ward's method. Through analyses of the dendrograms, mathematics was viewed as structured with limited student collaboration while science was more comprehensive. Despite being enrolled in a STEM program and with the adoption of the Common Core Standards (including the interactive nature of the Mathematical Practice Standards), mathematics was viewed as traditional and teacher-centered.			What metacognitive knowledge of communicative activities do novice secondary mathematics teachers have and how does this knowledge impact their practice? The knowledge of two novice teachers is compared in an in-depth case study. Through interviews and lesson study think alouds, this study explores the declarative, procedural, and conditional metacognitive knowledge of these teachers and the how their knowledge influences their instructional decision making. Comparisons between the two teachers, who graduated from the same university, illustrate the impact of their teacher education program as well as external factors in their educations. Suggestions for further research will be shared.		

Friday Morning Sessions 10:00 – 10:25

#66	Sierra Ballroom 1	Research: Science
Rethinking Next Generation Standards: Infusing Electrical Engineering Practices into a School Curriculum		
Melanie Shores, Arie Nakhmani, Michael Lipscomb, Karthikeyan Lingasubramanian		
Despite the progress and overwhelming success of modern technology and engineering, the engineering is still rarely found in the school curriculum. Nowadays, students are proficient in using tablets and computers, but they mistakenly assume that everything important has been already invented. As a result, teenagers are not motivated to understand the principles behind computing devices, which worsens the problem of engineers' shortage. We propose an approach that potentially will attract more students to engineering through development of embedded electronic games to solve modeled modern challenges. In our program, students learn about embedded systems, sensors and programming using hands-on experiments.		

#67	Sierra Ballroom 2	Research: Science
Elementary Students' Understandings of Scientific Concepts and Terminology		
Kelly Shepard		
For decades, researchers have examined the connections between students' knowledge of scientific terminology and their abilities to understand scientific concepts. Shore found that students' retention of vocabulary was enhanced by student-centered, constructive, and interactive teaching strategies. Whereas strategies that were passive, such as copying definitions from textbooks, were less effective (Shore, 2015). Science vocabulary was used by teachers to label objects and occurrences in nature, which promotes students' understandings of concepts (Glen & Dotger, 2009). The focus of the current study was to determine the effects of using student-centered strategies to teach science terminology on students' understandings of science concepts.		

#68	Sierra Ballroom 3	Research: Science
Yellowstone Science for Education		
Julie Angle		
Learn about an exciting new summer course that blends classroom instruction with outdoor adventure -- Yellowstone Science for Educators. This course was developed to encourage preservice teachers to experience science in a unique and personal setting. Invited speakers, who are experts in their field, share the science of the Greater Yellowstone Area (GYA) as they talk about plate tectonics, glaciation, extremophiles, supervolcanoes, and more. Then we drive to the Grand Teton and Yellowstone National Parks to experience the natural wonders of this majestic area. Course participants develop lessons plans that are specific to the science of the GYA.		

Friday Morning Sessions 10:35 – 11:10					
#69	**Suite S301B**	**Research: STEM**	**#70**	**Suite S302B**	**Research: Mathematics**
Using Problem-Based Mathematics to Teach STEM			*Impact of a Local Math Circle Program on Urban Middle and High-School Students*		
Cynthia Orona			Diana White		
Many teachers, including pre-service teachers, are uncomfortable with teaching STEM. The focus of this study is how elementary pre-service teachers defined STEM and problem-based mathematics to effectively teach STEM. Mathematics is one aspect of STEM which typically gets overlooked/underemphasized as greater emphasis is placed on the engineering aspect of STEM. By using problem-based mathematics, STEM can be incorporated in the classroom while involving students in real-life situations using the subjects together to reach possible solutions. This presentation will highlight some of the ideas students have used as well as encourage participants to think of ideas for their own classrooms.			Math Students' Circles are a form of informal education where mathematics professionals share their passion for mathematics with K-12 students, combining significant content with an atmosphere that encourages a sense of discovery and excitement about mathematics through problem solving and interactive exploration. Ideal problems offer a variety of entry points and can be approached with minimal mathematical background, but lead to deep mathematical concepts and can be connected to advanced mathematics. We present details on one local model aimed at underserved urban youth, sharing impacts from four years of quantitative data on their mathematical expectancy, achievement task value, and dispositions.		
#71	**Suite S370B**	**Hot Topic Session**	**#72**	**Suite S371B**	**Research: Science**
Fostering Learning Through Home-School Connections- The "Home Visit"			*Using Reflections to Explore In-Service Biology Teachers' Professional Growth*		
Lillian H Degand			Molly Weinburgh, Cecilia Silva, Kathy Horak Smith		
Why the Home Visit? Typically, ethnographers visit social settings in order to understand the "culture" of an ethnic group. However, classroom teachers, parents and most of all students benefit from this important component of teaching. The teacher offers opportunities to learn and suggest support for students. NO professional training necessary. Ofcourse, "safety " is a concern and finding time is a factor. Science and Math curriculum can be tailored to teaching situation based on the "home visit."			We examine biology teachers' reflections for (1) reasons for attending an 18-month PD integrating science, mathematics, and language and (2) perceptions of the elements providing the most growth. We used the overlap of the Zone of Proximal Development, Communities of Practice, and Interconnected Model of Professional Growth as the theoretical stance. The hybrid language of science and the 5R Instructional Model were used as the instructional framework. Four themes arose as reasons for selecting the PD. Four different themes arose as most beneficial elements. Implications for PD will be provided.		

Friday Morning Sessions 10:35 – 11:10

#73	Sierra Ballroom 1	Research: Mathematics
Classroom influences on young African American learners' mathematics identities		
Thomas Roberts		
Previous research has shown connections between pedagogy and mathematics identity (e.g. Boaler & Greeno, 2000) and student positioning and mathematics identity (e.g., Wood, 2013). Berry, Thunder, and McClain (2011) found early computational fluency to be a key factor in middle school African American males developing a positive mathematics identity. Traditionally, the research literature does not address the relationship African American elementary students form with mathematics. The purpose of this session is to discuss how third grade African American students' daily interactions with mathematics in the classroom can promote positive mathematics identities, which can lead them to long-term success in mathematics.		

#74	Sierra Ballroom 2	Research: Science
A Dissertation Exploring the Relationship of Nature of Science and Evolution		
Brenna Heaton, Julie Angle		
This session will address the research methodology that explores undergraduate freshman students' understanding of nature of science (NOS) and acceptance of evolution. In addition, this session will address the relationship between participants' understandings of NOS and acceptance of evolution. Specific demographic variables that allow the prediction of one's acceptance of evolution/understanding of NOS will also be discussed. The instruments used for the study include a recently developed Likert-scale NOS instrument called the VNOS-L, and the Measurement of the Acceptance of Evolution (MATE).		

#75	Sierra Ballroom 3	Research: STEM
K-12 STEM Education: a mobile app and web-based, curricular model		
Susanne Lapp, David D. Kumar		
Teacher educators have been charged to prepare current and future K-12 educators with the skills and strategies necessary to prepare ALL students for success in academically demanding STEM-related content professions. As teacher educators in Florida, we recognize that K-12 students come to the classroom with a range of language skills as well as academic content knowledge. Our presentation will address how we have taught K-12 educators to use a cutting edge curricular model which fuses content-specific STEM education with effectively structured disciplinary literacy strategies within a mobile app and web-based software environment to enhance the learning opportunities for all students.		

Friday Morning Sessions 11:10 – 11:35					
#76	**Suite S301B**	**Research: Science**	**#77**	**Suite S302B**	**Research: STEM**
A Demographic Overview of Secondary Science Education in Texas			*Development of an Instrument Measuring Preservice Teachers' Self-Efficacy for Educational Robotics Integration*		
Jennifer LeBlanc, Dane Bozeman, Carol Stuessy			Timothy Laubach		
With the passing of the Every Student Succeeds Act (ESSA), sampling successful schools for case study research will become a very important part of localizing education policy based on "best practice" research. In this study, we used a non-experimental descriptive research design (Gall et al., 2007), to identify and describe a sample of Highly Successful and Highly Diverse (HSHD) high schools in the state of Texas based on the Student Aggregate Science Score (SASS). Using SASS, we provide a demographic overview of the state of science education in Texas, and describe a method for sampling schools for case study research.			The recent passage of the STEM Education Act of 2015 broadened STEM education to include computer science. Since educational robotics is perceived by many to fall under the purview of computer science, teachers who teach STEM may be asked to integrate educational robotics through extracurricular as well as intracurricular pathways. Teachers' beliefs in their capacity to work effectively with educational robotics may be a significant factor in determining effective educational robotics integration. Thus, the purpose of this study was to develop a valid and reliable instrument that measures preservice teachers' self-efficacy for educational robotics integration. Results will be shared.		
#78	**Suite S370B**	**Research: Mathematics**	**#79**	**Suite S371B**	**Research: Mathematics**
An Assessment of Middle School Mathematics Attitude			*Using Drawings to Explore Beliefs about Teaching and Doing Math*		
Kristina Gill			Ben Wescoatt		
Research was conducted in a suburban school district using the Math and Me Survey. The results of this study showed no difference in enjoyment of mathematics or mathematics self-perception based on race, which is a contradiction of current literature. It also showed there is a difference in middle-school students' self-perception of ability as well as enjoyment of mathematics based on gender and a significant difference of enjoyment of mathematics between 5th and 6th grade students. Further implementation of the Math and Me Survey at other school districts is being conducted and these results will be presented in this session.			Teachers play an important role in shaping their students' beliefs about mathematics, possibly impacting the students' future careers. This study analyzes a series of participant made drawings to explore preservice elementary teachers' beliefs about doing math. Students in a mathematics content course for teachers created drawings of mathematicians doing math, themselves doing math, and their students doing math. Using the framework of Farland-Smith (2012) as modified by Bachman, Berezay, and Tripp (2016), the person, the mathematics, the action, the location, and affect in the drawings are described and compared. Trends within and across drawings will be discussed.		

Friday Morning Sessions 11:10 – 11:35					
#80	**Sierra Ballroom 1**	**Research: STEM**	**#81**	**Sierra Ballroom 2**	**Research: Science**
The Implicit VS Explicit Math in integrated STEM Activities			*Examining Preservice Teachers Moral Sensitivity in the Context of Socioscientific Issues*		
Cathrine Maiorca, Travis Olson			Emily Westbrook, Jonathan M. Breiner		
Often integrated STEM problems are intermittently dispersed between mathematics content. In most non-routine engineering problems the mathematics is implicitly built into the problem and the rich mathematical structure necessary to complete the task it is often overlooked by students when they solve them. Twenty-four fourth and fifth grade students participated in an after school integrated STEM program. Data was collected included interviews, and video recordings of each session. Initial findings indicate students were unable to make connections to the mathematics that they were applying when it was implicitly built into the problem. Further data will be examined to determine whether these findings remain the same.			This study examines preservice teachers' moral sensitivity before and after a socioscientific project in a science class at a Midwestern university and compares them with non-education students in the same class. All students were administered a pre- and post-test using the Test for Ethical Sensitivity in Science (TESS) and all study participants completed the project. The preservice teachers were co-enrolled in a science lab that embedded Nature of Science (NOS) components throughout each lab whereas the non-education students were not intentionally exposed to NOS. Findings will be presented.		

Friday General Session and Lunch 12:00-1:30 (Honeysuckle)

Keynote Speaker

David A. Williams

Director
Ronald Greeley Center for Planetary Studies
NASA Planetary Aeolian Laboratory

Asteroids, Ion Propulsion, and NASA's Dawn Mission to Asteroid Vesta and Dwarf Planet Ceres

Dr. David A. Williams is an Associate Research Professor in the School of Earth and Space Exploration at Arizona State University, Tempe, Arizona. Dr. Williams is the Director of the Ronald Greeley Center for Planetary Studies, the NASA Regional Planetary Information Facility at ASU. He is also the Director of the NASA Planetary Aeolian Laboratory, which administers wind tunnels at ASU and the Ames Research Center in California.

David is currently performing research in volcanology and planetary geology, with a focus on planetary mapping, geochemical, and remote sensing studies. His research has included computer modeling of seismic wave propagation through planetary interiors, visible and near-infrared spectroscopy of the lunar surface, planetary geologic mapping of the satellites of Jupiter, the planet Mars, and the asteroid Vesta, computer modeling of the physical and geochemical evolution of lava flows in a variety of planetary environments, and petrologic study of lava samples from Mount St Helens.

He was involved with NASA's *Magellan* Mission to Venus and *Galileo* Mission to Jupiter. He is a Co-Investigator on the European Space Agency's *Mars Express* orbiter mission, and he is a Science Team Member on NASA's *Dawn* Mission to asteroid Vesta and dwarf planet Ceres. In 2014 David was elected a Fellow of the Geological Society of America, and asteroid 10,461 DAWILLIAMS was named in his honor.

Friday Afternoon Sessions 1:40 – 2:05					
#82	**Suite S301B**	**Research: Science**	**#83**	**Suite S370B**	**Research: Mathematics**
Experiences in Schools: Faculty Member Returning to K12 Education			*The Interactive Nature of Rectangles in Teaching Algebra Reasoning to Preservice Teachers*		
Catherine Koehler			Terri Kurz		
This presentation is an ethnography case study of the experience of a university professor as she maneuvers through the K12 system after being away for 14 years. Having left the K12 system in 2002 to pursue a doctorate in education, I d ecided to revisit the K12 system, e.g. middle school, but this time as an administrative intern to experience how teaching and learning has changed in the past 14 years since I was a 9th grade science teacher. The challenges and strategies of maneuvering through this system is a compelling story that every university faculty member needs to hear.			The rectangle has potential to provide a visual connection regarding the meaning of quadratic equations. Preservice teachers created activities that connected rectangles to linear and quadratic equations in a mathematics content course that emphasized patterns, functions and modeling. The preservice teachers were successful at creating patterns and translating those patterns to equations through algebraic reasoning. However, they had difficulty in explaining their reasoning and connecting it specifically to the equation. Those who struggled primarily relied on guess and check. They could not articulate an algebraic process to explain the connectedness of the visual representation to the equation.		
#84	**Suite S370B**	**Research: Mathematics**	**#85**	**Suite S371B**	**Research: Mathematics**
How preservice teachers plan mathematics lessons for English Language Learners using technology?			*Secondary-Tertiary Transition in Mathematics: A Multifaceted Issue*		
Mi Yeon Lee			Devon Gunter		
This study investigated how preservice teachers (PSTs) plan mathematics lessons for English Language Learners (ELLs) using technology called LessonSketch. The data were LessonSketch depictions created by 42 PSTs enrolled in elementary mathematics content courses at a large Southwestern university. Data were analyzed using an inductive content analysis approach. Findings suggest that many PSTs took a procedural approach to creating depictions by focusing on teaching procedures or skills in a traditional way. Also, while their depictions included some general strategies for teaching ELLs, the strategies were not content-specific for teaching mathematics. Implications for teacher education programs will be discussed.			Secondary-tertiary transition in mathematics is likely a contributing factor to poor six-year college graduation rates in the United States. A systematic review of the literature provided frameworks for investigating its impact and helping students mitigate its negative effect on success in college mathematics. Results and directions for future research will be discussed.		

Canceled

Friday Afternoon Sessions 1:40 – 2:05					
#87	**Sierra Ballroom 1**	**Research: Science**	**#88**	**Sierra Ballroom 2**	**Research: Mathematics**
Structural Equation Modeling of Factors Influencing Intent to Pursue a Graduate Degree			*Professional Development Connecting ASSURE Model for Math Teaching*		
Adriana Lunsford			Hsing-Wen Hu		
This research project will aim to answer the following question: What are the direct and indirect effects of undergraduate chemistry students' prior laboratory experiences, the authenticity level of a students' current science laboratory experience, and students' characteristic beliefs about chemistry before and after their current laboratory experiences on their intent to pursue a graduate degree in chemistry? The proposed quantitative study incorporates an explanatory research design using a cross-sectional method for data collection. Questions of both correlation and causation will be considered in answering the guiding research question through structural equation modeling analysis.			The objective of the study is to address the need for technology in K-12 mathematics classrooms by examining the effects of a pilot professional development program using the ASSURE model. This research project uses a mixed methods study design to investigate how a group of mentor teachers choose to implement technological, pedagogical, and content knowledge (TPACK) in their classroom after participating in the professional development program. The project expects the professional development to enhance positive impact between mentor teachers and students on TPACK practices for math teaching.		

Friday Afternoon Sessions 2:15 – 3:05

#88	Suite S301B	Regular Session
Building a STEM Mindset		
John Staley		
What actions must we take to ensure that we do not miss out on this moment in time? As schools prepare to implement the Next Generation Science Standards and continue the implementation of the Common Core Mathematics Standards (or new state standards), there are unique opportunities for the science and mathematics education communities to collaborate. Inquiry-based labs and problem-based learning are just two of the strategies teachers can investigate as they work to develop a STEM Mind-Set that directly connects science and mathematics concepts and activities in the classroom. This session will highlight the structure and key activities of a professional development model that involves back-mapping from high school science and mathematics courses to K – 8 courses in order to make direct connections between concepts and learning strategies that support the development of STEM Ready Students.		

#90	Suite S370B	Regular Session
Assessing Equity Among Diverse Populations -Using Area Estimation		
George Selitto		
Estimating the area under a curve is a typical application in calculus. This concept can also be made accessible to students of all grade levels - from junior high school through college. This is a hands-on presentation of real-world situations and applications from both mathematics and economics. In particular, we explore a technique used to measure how equitable income is distributed in a population. Lastly, we discuss how this topic can be expanded to other measureable quantities. Technology is used.		

#90	Suite S371B	Hot Topic Session
The Talk: STEM Teaching Accountability vs. Reality		
Bill Jasper, Andrea Foster		
This hot topic session will provide open forum for participants to argue the good, the bad, and ugly issues related to state accountability systems and their impact on STEM teaching and learning. The current culture of accountability clearly has influenced the classrooms of today in significant ways. Empirical evidence suggests that the use of flawed indicators produces unreliable and unrepresentative inferences and decisions. High-stakes testing produces teaching and testing practices that lead to inflated test scores and further disadvantage already disadvantaged students. Let's talk about it. Come share your view.		

#91	Sierra Ballroom 1	Regular Session
History of Mathematics in the Classroom: A Focus on Cultures		
Brian Evans		
This presentation gives a brief overview of the history of mathematics through the contributions from various cultures. It provides ideas for using mathematics history to motivate students. The presentation will be interactive and have teachers solve historical problems and we will discuss how mathematics history can be used in the classroom. Topics will briefly include mathematics in ancient Egypt, ancient Mesopotamia, ancient Greece, China, India, the Islamic World, the Pre-Columbian Americas, Europe, and the United States. The development of mathematics from ancient times, the Middle Ages, and throughout the 17th to 21st Centuries will be briefly examined.		

Friday Afternoon Sessions 2:15 – 3:05

#92	Sierra Ballroom 2	Research: Science	#93	Sierra Ballroom 3	Regular Session
Two Statewide Rollout Professional Development Models for NGSS and Common Core			*Mathematics is Naturally Interesting*		
Georgia Cobbs, Ken Miller			Chuck Emenaker		
Having just completed two juxtaposed three-year grant projects in Montana, (specifically NGSS and the Common Core professional development (PD) model rollouts), these projects will be described in detail and discussed providing participants with project successes and lessons learned. Detailed descriptions of PD meetings will be shared, including face-to-face and blended sessions. Unique combinations of self-pacing, asynchronous structure, instructor facilitation, collaboration with peers, and access to online resources has proved to be highly effective method of bringing professional learning to teachers in schools. The presentation will also describe continuations as a result of the projects.			A good deal of what students encounter in nature or even their backyard has interesting mathematical underpinnings. What could be more fun than learning mathematics and physics while exploring your yard or local woods? In this session a number of class-ready projects will be provided that are based on common fauna and flora. Samples and ideas for assessment rubrics that can be used when evaluating student projects will also be presented and discussed.		

Friday Afternoon Drink Break (On the Plaza) 3:15 – 3:35

Friday Afternoon Sessions 3:35 – 4:15

#94	Suite S301B	Research: Science	#95	Suite S302B	Regular Session
Addressing Student Misconceptions about Diffusion and Osmosis through Direct and Inquiry Instruction			*Answering the "What Works" Question: Designing Rigorous Trials of Math/Science Interventions*		
Erin Dixon			Jessaca Spybrook		
An understanding of diffusion and osmosis provides a necessary foundation for more complex biological concepts. However, many high school students have misconceptions about diffusion and osmosis. For my dissertation research, I examined ninth grade students' understanding of and misconceptions about these concepts after participation in either direct or inquiry instruction. Two different instruments were used to assess student understanding, a multiple-choice instrument and an open-ended response instrument. This presentation will emphasize results from the open-ended response instrument and changes in students' understanding of and misconceptions about diffusion and osmosis.			The purpose of this session is to help math and science education researchers plan studies that seek to establish causal links between interventions and student outcomes. In many cases, these studies use a randomized trial in which teachers or schools are randomly assigned to either the treatment group or a comparison group. A critical question is how many students, teachers, or schools are necessary for a given study? In this session, we will examine the sample sizes necessary for planning rigorous efficacy trials. The session will include a demonstration of the Optimal Design Software, a free program for planning studies.		
#96	**Suite S370B**	**Regular Session**	**#98**	**Suite S371B**	**Regular Session**
STEM in the Classroom: Salta, Coquí, Salta (Jump, Frog, Jump)			*Teaching Elementary Science…I Think I Can?!*		
Lynn Columba			Madelon McCall		
Science, Technology, Engineering, and Mathematics are modeled in an interdisciplinary unit taught in two fourth-grade classrooms to underrepresented students. The coquí (frog) is the school's mascot, so the students created origami frogs to promote school spirit and to collect data on the measurements of their frogs' jumps. After collecting the data the students organized their data into graphs. Next, the students collected data on their jumps like a coquí (frog) and created graphs using calculator tape. Other activities, which represent the STEM content areas, such as the integration of ipad apps will be described in the session.			The presenter will share findings from the initial implementation of a university laboratory science course designed to prepare students pursuing a degree in Elementary Education to teach science to elementary students. Included is a discussion of student confidence and attitudes toward science and science teaching, student perceptions of the use of inquiry-based activities in a college science course, and student impressions concerning the embedded laboratory experience.		

Friday Afternoon Sessions 3:35 – 4:15

#99	Sierra Ballroom 1	Hot Topic Session
Building on a Classic		
Sarah Saltmarsh, Malissa Chavez-Thibault, Jackie Hernandez, Peter Rillero, Michael Kelley, Joi Merritt		
Problem-based learning is an instructional approach where learners grapple with meaningful problems and collaboratively work toward resolutions (Rillero, 2015). Teachers may be unfamiliar with this type of instruction; however, when well-planned with a clear and focused outcome, the potential benefits are numerous. This student-centered environment allows each learner to drive their own experiences and provides teachers with insights into students' critical thinking skills. Participants will experience a problem-based science lesson from start to finish. Following the experience, they will engage in a discussion centered on how the nine components of problem-based learning enhanced their understanding of the content.		

#100	Sierra Ballroom 2	Regular Session
Engaging Class Openers that Enhance Students' Learning of Probability and Statistics		
Megan Che, Stacy Reeder, Juliana Utley		
The purpose of this session is to share a variety class openers that promote student learning of probability and statistics concepts as well as resources for classroom teachers. Participants will be engaged in solving and discussion of these tasks throughout the presentation. These tasks are designed to be conducted in a time frame of 5-10 minutes, making these tasks ideal for teachers seeking to transform their practices of opening and closing classes. Many teachers use those crucial opening and closing minutes as test-prep or individual practice time; these tasks provide an alternative that actively engages students in reasoning about data.		

#101	Sierra Ballroom 3	Research: Science
Examination of Perceptual Variable Relationships from Problem-Solving Lessons in Second Life Simulation		
Trina Davis, Gerald Kulm		
The Knowledge for Algebra Teaching for Equity Project, funded by the National Science Foundation, enriches the education of STEM teachers by using a virtual classroom simulation in Second Life (SL) to provide preservice mathematics teachers early teaching experiences that addressed topics in algebra and equity. The current study examines relationships between key perceptual variables (e.g., teaching efficacy, SL ease of use, technology comfort) related to preservice teachers' experiences in problem solving lessons in a simulated classroom. Correlations were computed to examine the relationships between several perceptual variables. Preliminary results show statistically significant relationships between multiple variables (e.g., efficacy, comfort, engagement).		

Friday Afternoon Sessions 4:25 – 4:50					
#102	**Suite S301B**	**Research: Mathematics**	**#103**	**Suite S302B**	**Research: Science**
Mathematical Lessons Learned in Ethiopia and Japan			*Deconstructing Dinosaurs: A Proposed Learning Progression Aligned with Cross-Cutting Concepts of the NGSS*		
Heidi Higgins, Tracy Hargrove			Luke Lyons, Carol Stuessy		
In this session, we will share findings from a global study that investigated how children in Ethiopia and Japan approach computation and the algorithms that are commonly used including both invented and traditional methods. We will also share what we learned about informal measurement systems that are taught in these countries and how they are used in their respective communities. Data were collected from classroom observations of students solving computational problems and through analysis of the textbooks used in both public and private schools.			Learning progressions (LP) offer a way for curriculum to be integrated across typical boundaries. According to Duschl (2011), learning progressions should foster conceptual understanding ("generative ideas"), promote scientific practices, and engage the learner ("core ideas"). Dinosaurs allow for instant engagement in a K-12 classroom and act as a medium for conceptual knowledge across content areas. Expert interviews with science education and paleontology experts were analyzed to establish themes for the LP. The experts' statements were then compared to the NGSS to establish effective topics for integrating dinosaurs into the current K-12 curriculum.		
#104	**Suite S370B**	**Research: Mathematics**	**#105**	**Suite S371B**	**Research: Mathematics**
Promising Chaos: Changes in Concept Maps of Future Elementary Math Specialists'			*Effects of a Summer Program for Underserved Elementary Children on Mathematics Learning*		
Kansas Conrady, Adrienne Redmond-Sanogo			Elaine Tuft, Michael Bachler		
Pre/Post concept maps were collected during coursework in an elementary mathematics specialist course focused on the concept of number. While a quantitative analysis of width, breadth, and depth indicated little change in understanding, a qualitative analysis of the content within the maps shows pre/post differences in the EMS graduate student's thinking. Further analysis also indicates that while these changes do exist, participants may still be in the process of making sense of their new understandings even though the course ended, thus leaving the future EMS in a place of limbo.			Summer learning loss has been the focus of much research. This research has shown that without ongoing opportunities to learn and practice essential skills, students fall behind on measures of academic achievement during the summer months, losing as much as two months of grade-level equivalency in mathematical computation. This session will describe a summer school program for underserved elementary-age children. The purpose, organization, and curriculum of the program will be explained together with lessons learned through two years of implementation. The mathematics portion of the program will be highlighted along with its effects on the mathematics learning of participating students.		

Friday Afternoon Sessions 4:25 – 4:50

#105	Sierra Ballroom 1	Research: STEM
Creating a Model of Acceptance: Investigating Preservice teachers' conceptions of Latino parents		
Cherie McCollough, Olga Ramirez		
Culturally relevant math and science is defined as teaching that connects mathematics and science to the cultural experiences of students in a particular classroom. TAMU-CC and UT-RGV had developed a preservice teacher (PST) model using family learning that requires PSTs to examine their own perceptions of parents and their children whose culture and language may or may not differ from their own culture. The authors recommend that PSTs have authentic teaching experiences with diverse cultures early in their training and teaching careers, helping them to realize that students should not have to assimilate their cultural identity to achieve academically.		

#106	Sierra Ballroom 2	Research: Science
Impacts of Educative Multi-Year Science Teacher Professional Development		
Max Longhurst, Todd Campbell, Paul G. Wolf, Daniel C. Coster		
Evidence of long term, multi-year professional learning will be presented in this session. Specifically, data from this study suggest that students of teachers who participate in educative multi-year professional learning exhibit modest achievement gains following one year of PD, however, following a second year of PD the achievement gains continue to be realized. If we are to accomplish the aims of reformed based science instruction, especially the transformative visions of teaching and learning outlined in the newest U.S. standards documents, professional development for science teachers must be crafted in ways that link teacher learning and practice to student learning outcomes.		

#107	Sierra Ballroom 3	Research: STEM
Using Multi-Media Portfolios as Assessment		
Deborah Roberts-Harris, Christopher Copeland		
As an elementary science methods instructor I have realized that helping pre-service elementary teachers see how science is really an integral part of almost any content areas is essential. Students experience integrating math, science, technology, engineering and literacy. Their final assessment is to create a multi-media portfolio that summarizes/synthesizes the key ideas they have learned in the course. The parameters for the assignment are broad, and instructions for the assignment students call "vague." But this is intentional. I am amazed by the products they create and the reflection they have put into it, and often, so are they.		

Saturday Breakfast- Continental (On the Plaza) 8:00 – 9:00

Saturday Morning Sessions 8:30 – 9:30

#108	**Honeysuckle**	**Innovations Showcase: Science, Mathematics, and STEM**

Integrating Social Studies into STEM Lessons: A Focus on English Learners

Margarita Jimenez-Silva, Karen Guerrero, Gale Ekiss

The Arizona Geographic Alliance hosted it's 3rd Annual STEMSS Institute in the summer of 2016, offering K-12 teachers an opportunity to create STEM lessons that integrated social studies content while addressing the needs of ELs. We will share the specific strategies used by teachers to scaffold STEM and social studies content for ELs, highlight a number of lessons created during the Institute and available at no cost to teachers, and provide teachers' perspectives on participating in the Institute. Qualitative and quantitative data gathered from the Institute will be shared.

An Issue Driven Project in AP Biology: Focus on the Seven Science Practices

Luke Lyons, Joy Killough

AP Biology curriculum reforms effective in 2013 added science practices focusing the curriculum. These practices ask students to use evidence to support ideas generated through critical inquiry. We present a lesson on a high interest topic, dinosaurs, examined through the lens of these science practices. This lesson creates a student centered learning environment using anchored instruction through a mock trial. Can a raptor be recreated? Should it? We offer an extension to a developed learning progression for AP science students to decide what is fact and what is fiction in the current state of DNA research.

Attending to STEAM in Preservice Education

Caitlin Kimmet, Ken Miller
This presentation describes an Art exhibit created by the preservice Noyce Scholars at Montana State University Billings. The light strips were driven by Arduino microprocessors and software. Preservice teachers programed the light strips all in a synchronous display in an art gallery on campus. The work is a salute to Robert Noyce (for whom their scholarships are named) who was the co-inventor of the microprocessor. The presentation concludes with a video of the culminating event.

Graphing Skills: Pre-Service K-8 Teacher Self-Efficacy and Learning Progression

Rolando Robles, Peter Rillero

Science, Technology, Engineering, Arts and Mathematics (STEAM) activities can be effectively used in the elementary classroom. This presentation will describe a quasi-experimental control group study investigating the effects of a science methods class intervention focusing on science graphing skills with a business-as-usual control group. The graphing instruction will be showcased, as well as results of a pretest and posttest of the Test of Graphing Skills (TOGS), and participant interviews. One research goal is to improve K-8 science teacher education by improving upon graphing understanding, graphing abilities in the sciences, and teacher self-efficacy through innovative strategies.

Mathematics, Architecture, and Technology

Kelly Shepard

Frequently, students do not make connections between the mathematical concepts they learn in class and the world outside of their classrooms. Through this project, students used mathematics to learn about architecture. The projects' hands-on activities were based on the Common Core State Standards for Mathematics as well as the Mathematical Practices. The activities focused on measurement, scale, proportions, and algebraic equations. The technology component of the project was a free, user-friendly Internet accessible software that enabled students to build 3D electronic models of skyscrapers.

Dancing and Mathing - An Integrative Approach

Erik Stern, Rachel Bachman, Julian Chan

Experience how activities using full-body open-ended choreographic movement problems can introduce math concepts in palpable ways, teach collaborative learning skills, promote problem solving persistence, and form positive attitudes about mathematics learning. In addition, learn how these activities were developed in an interdisciplinary general education college course that satisfies creative arts and quantitative literacy requirements.

iPad Statistic's Apps

Amy Adkins, Lina DeVaul, Dawn Lockett, Taro Ito

iPad Apps offer engaging platforms for high school students to learn statistics. Due to the newness of digital curriculum, this research seeks to inspire mathematics educators to consider the attributes of statistics apps that would support maximized learning. Limited research exist to help teachers consider the affordances that apps offer to teach content that emphasizes collecting, analyzing, interpreting, and prediction of data. Statistical information pertaining to distribution of center, shape, and spread will be examined and discussed through available app selection. Math modeling through apps with visual representation will bridge understanding of statistics with real world data and function concept.

Saturday Morning Sessions 9:40 – 10:30					
#109	**Suite S301B**	**Research: Mathematics**	**#110**	**Suite S302B**	**Regular Session**
Impact of a Mathematics Content Course on PSTs Knowledge of Complex Fractions			*Making a Three Dimensional Teacher*		
Elif Safak, Jennifer Tobias			Ken Miller, Rayelynn Connole, Chris Pavlovich		
We will share our work investigating the impact of a mathematics content course on; (a) preservice teachers' (PSTs) understanding of complex fractions and (b) their ability to interpret mathematical procedures for operating with complex fractions. Data encompasses PSTs' written work with their symbolic & pictorial solutions and their explanations on several tasks given before and after series of exploratory instructions on fractions. The results indicated that PSTs' exhibited growth in their ability to explain mathematical procedures and concepts in their solutions, displayed better understanding of fraction concepts particularly in complex fractions, and exhibited flexibility in interpreting and modelling complex fractions.			In most teaching careers, we have facilitated student learning through labs or had students observe demonstrations so they could experience science first hand. Our focus was on students learning content rather than on having them make sense of science phenomena. Learning content is important, but the NRC research clearly shows that learning content cannot be separated from the doing of science. If we want students to learn content and apply their knowledge, then they must use the SEPs and CCs with the DCIs. This presentation will describe an activity from a typical one-dimensional approach and how this same activity can be done integrating the dimensions as suggested by NGSS.		
#111	**Suite S370B**	**Research: STEM**	**#112**	**Suite S371B**	**Regular Session**
Integrating Physics with Algebra 2 in a Secondary STEM Classroom			*How to get from STEAM to STREAMS*		
Elayne Bowman, Clay Bowman			Carolyn Riley, Linda Figgins		
Algebra 2 and Physics are not often thought of as companion courses, however, allowing real world Physics applications to drive the Algebra learning makes both courses more enticing to high school students. This is a study of two teachers from a large Midwestern high school who wondered what would happen if they created a STEM course that integrated Algebra 2 and Physics into one class period. We will consider the struggle and success that occur as one course driven by state testing, Algebra 2, dictates the timeline for a curriculum, while the other course provides the underlying practical concepts.			Our presentation expands STEAM to STREAMS, which rightly includes reading and social studies as equal partners to science, technology, art and mathematics. This presentation will focus on the process skills of observing, measuring, classifying, predicting, inferring, communicating which are then combined into more complex skills such as understanding cause and effect relationships, organizing and analyzing data, and designing investigations. Moving from STEM to STREAMS helps support student learning and provides elements to the learning experience, which go beyond what is already included in STEAM.		

Saturday Morning Sessions 9:40 – 10:30

#113	Sierra Ballroom 1	Regular Session

Utilizing Culturally Relevant Stories in Mathematics: Research and Resources

Amy Corp

Stories are a powerful way to connect with students especially when read aloud. This session describes how students reacted to their teacher using stories featuring African American characters to teach mathematics in two diverse classrooms in a 12-week study. Overwhelmingly positive results from all the students and teacher reiterate the need for culturally responsive pedagogies in learning mathematics. This session will share the research design and results, the stories and activities used, an ongoing list of stories featuring minority characters and mathematical connections for these stories. A time for questions and discussion will be included.

#114	Sierra Ballroom 2	Regular Session

What's My Next? Exposing Students to Exciting Career Opportunities in Laboratory Medicine

Robin Cusick

Event attendees will be introduced to a new innovative and interactive program titled "What's My Next," which is designed to expose students to exciting career opportunities in laboratory medicine and pathology, and to showcase the important lifesaving roles of lab professionals. Many students have no idea that so many career options are readily available in the medical laboratory. Currently, there is a dire shortage of lab professionals in the United States. The "What's My Next" program walks students through the wide variety of disciplines within the laboratory profession and related education requirements, and includes an e-learning module, Lab Hero Challenge.

#115	Sierra Ballroom 3	Research: MATH

Early Connections: Building Professional Networks as a Pre-Service Secondary Mathematics Teacher

Kansas Conrady

A state-wide conference for future mathematics educators was designed to bring together pre-service secondary mathematics educators from across the state with hopes of connecting the PSST to each other and the greater network of mathematics educators within the state. The one-day conference was funded by a small state level grant and provided sessions focused specifically on early career needs with many opportunities for professional networking. Motivations, encouragers, and struggles for making this conference happen will be shared along with hopes for future endeavors.

Saturday Morning Sessions 10:40 – 11:30

#116	Suite S301B	Regular Session	#117	Suite S302B	Research: Mathematics
Elementary Mathematics Teachers' Content Knowledge: A Discussion of Two MSP Projects			*Measuring the Quality of Teaching with the Dynamic Geometry Software*		
Gregory Chamblee, Georgia Cobbs			Zhonghong Jiang		
The purpose of this session is to discuss two United States Department of Education Mathematics and Science Partnership grants (Montana's STREAM Project and Georgia Southern University's Endorsement Project) that focused on improving the content and pedagogical knowledge of practicing K-5 mathematics teachers. Delivery methods, content foci, participant data, and content/pedagogy assessment data will be compared and contrasted. Professional development content and pedagogical recommendations will be noted based on these findings.			A project compared the effects of utilizing Dynamic Geometry software in high school geometry teaching with instruction that does not make use of computer tools. The basic hypothesis of the study is that use of DG software to engage students in constructing mathematical ideas results in better geometry learning for most students. As a measure of the teaching quality of the experimental (DG) group teachers, a DG Implementation Questionnaire was developed and administered to those teachers six times across a school year. A qualitative analysis showed that the DG teachers provided good quality of the DG instruction in their classrooms.		
#118	**Suite S370B**	**Research: Mathematics**	**#119**	**Suite S371B**	**Regular Session**
Developing Preservice Teachers' Understanding of Fraction Subtraction and Fraction Multiplication for Teaching			*Linking Literacy: Methods of Integrating Literature in Mathematics and Science Classrooms*		
Elif Safak			Elaine Cerrato Fisher		
Interpreting and making sense of student work, developing mathematical tasks that are level appropriate and accurate, modelling with mathematics by using pictorial, symbolic and verbal representations are integral aspects of teaching mathematics. In this presentation, I will discuss an attempt to promote development of preservice teachers' (PSTs) understanding of fraction concepts particularly fraction subtraction and multiplication. In this study, I analyzed PSTs' work on series of tasks that have a diagnostic potential in identifying PSTs conceptions and misconceptions. I will share the findings about PSTs' progress as well as how the tasks performed in eliciting PSTs' mathematical thinking.			In recent years there's been an increasing emphasis on content area literacy to help prepare students better address challenges in the 21st century. In alignment with the Principles and Standards for School Mathematics (NCTM, 2000) and NGSS Framework for K-12 Science Education (2011), STEM integration has been suggested as a method to model a multidisciplinary approach while offering meaningful learning experiences (NRC, 2012). The purpose of this presentation is to share and explore ways in which the integration of literature in the classroom might improve literacy skills while supporting STEM topics. The session will include examples of content and teaching connections, lesson ideas and a variety of resources.		

Saturday Morning Sessions 10:40 – 11:30

#120	Sierra Ballroom 1	Research: Mathematics

Validation of the Mathematical Modeling Knowledge Scale (MMKS) with Practicing Teachers

Reuben Asempapa

This study investigated teachers' knowledge of the nature of mathematical modeling through a survey design. The author begins by reviewing the literature on teachers' content knowledge and mathematical modeling, noting the effect of content knowledge on teachers' profession. Next, the author discusses the five main phases used in developing the scale to represent knowledge of the nature of mathematical modeling. Cronbach's alpha reliability and factor analysis showed teachers' knowledge of the nature of mathematical modeling was unidimensional. This study suggests the scale to be a valid, reliable, and feasible tool for measuring teachers' knowledge of the nature of mathematical modeling.

#121	Sierra Ballroom 2	Research: STEM

University-Community Partnership: A Case of Positive Effect on STEM Undergraduate and EC-6 Students

Tapti Sen, Mamta Singh

There is growing recognition that education needs to engage in partnerships with universities and local communities. This study presents partnership development among a university, community organizations, and a local school system to enhance student interest in STEM. A brief discussion of the context in which these partnerships were established and maintained during this study. The structure and functions of partnerships will be discussed. The study addresses various levels of student development from classroom behavior improvement and school attendance to increase students' interest in the foundations of STEM education, undergraduate students' positive experience in STEM education as informal educators as a result of this partnership.

#122	Sierra Ballroom 3	Research: Mathematics

What I Need: Preservice Secondary Teachers Perceptions of Their Needs

Kansas Conrady

Providing experiences to help pre-service secondary mathematics teachers transition from student to teacher is a foundation for teacher education programs and a variety of stakeholders bring their perceptions to the table in deciding what those experiences should be. Unfortunately, the voice of the PSST is often minimized or even dismissed in conversations about what is important in their education. Preliminary findings from survey and interview data collected from PSSTs and first-year teachers suggest not only a focus on classroom management, testing, and teacher evaluation but also struggle to understand connections with and between each of these larger elements.

Saturday Morning Sessions 11:40 – 12:30					
#123	**Suite S301B**	**Regular Session**	**#124**	**Suite S302B**	**Regular Session**
Grand Challenges in Mathematics Education			*Building STEAM: Using Mathematics to put the A in STEM*		
Trena Wilkerson, Doug Clements			Diane Kinch		
Other fields have identified a list of Grand Challenges as a way to prioritize the most pressing problems that research should address. In the March 2015 Journal for Research in Mathematics Education issue, the National Council of Teachers of Mathematics Research Committee wrote a commentary that argues for initiating this approach for mathematics education. If the field were to identify a list of Grand Challenges, what might it include? How could we initiate a process to generate that list? What are the risks? Come engage in a discussion about potential grand challenges that could inform research and practice in mathematics.			Creativity is at the heart of innovation. Paul Halmos wrote, "Mathematics is a creative art because mathematicians live, act, and think like artists." Los Angeles County's Technology Enhanced Arts Learning project assists educators make connections between the Visual and Performing Arts Standards and the Common Core Standards. In this session we will examine this project from a mathematical perspective, connecting the Visual and Performing Arts Standards with mathematics standards in K-6. The intention is to give access to all students, in particular those from low socio-economic backgrounds, English Learners, and students with special needs to academic achievement through arts integration.		
#125	**Suite S371B**	**Regular Session**	**#126**	**Sierra Ballroom 1**	**Regular Session**
Fostering and Improving Small-Group, Student-to-Student Discourse: A Professional Development Course			*Web-based tools to facilitate collaborative experiences in methods of teaching STEAM courses*		
Sarah Quebec Fuentes			Timothy Surrette		
This presentation reports on a long-term professional development course that guided inservice teachers in learning how to interact with students while they are working collaboratively to promote and improve student-to-student communication. The teachers progressed through a four-stage process: (1) evaluate group dynamics, (2) evaluate student communication, (3) evaluate teacher communication, and (4) use teacher interventions. The first three stages allowed teachers to examine the nature of small-group communication in one of their classes and identify ways in which this communication could improve. The fourth stage was an iterative process through which teachers tried research-based interventions to foster small-group, student-to-student discourse.			Research indicates the importance of providing students with opportunities to practice and develop 21st century skills including collaboration and communication. The target audience for this interactive workshop is university faculty who teach undergraduate level educational methods courses in the STEAM disciplines in online and/or hybrid formats. This presentation will introduce educational tools and learning platforms capable of supporting collaborative learning experiences that promote a high level of communication among students in an online environment. Additionally, several web-based instructional strategies will be highlighted that facilitate collaborative learning experiences related to topical discussions, lesson/unit planning, and reflection on teaching practices.		

Saturday Morning Sessions 11:40 – 12:30					
#127	**Sierra Ballroom 2**	**Regular Session**	**#128**	**Sierra Ballroom 3**	**Research: Mathematics**
Elementary Education Majors Develop Formative Assessments to Promote Conceptual Understanding			*Examining Students' Understanding of Mathematical Communication*		
Susan Cooper			Kathy Horak Smith, Molly Weinburgh, Cecilia Silva		
Formative assessments help move student teachers away from telling students what they know toward digging deeper into what their students are thinking. Good formative assessments are engaging, making the learner want to find out more about a concept so that the learner develops conceptual understanding of core ideas in science. I will describe assignments that were designed to help elementary education majors in my science methods class learn to think deeply about their own science understanding as they learn how to teach challenging science concepts to elementary children using their own formative assessments based on student preconceptions.			In this session, we describe a tool developed for examining students' understanding of mathematical communication using modes of communication, content standards, and process standards. We then describe a study in which we used the tool to analyze pre- and post-writing samples. The participants in this study were 5th and 8th grade ELL students involved in a three-week summer school program with a strong focus on NCTM's communication process standard. Data were sorted by grade level and analyzed by composite score, sub-scores, and word count. Trends by grade level will be presented.		

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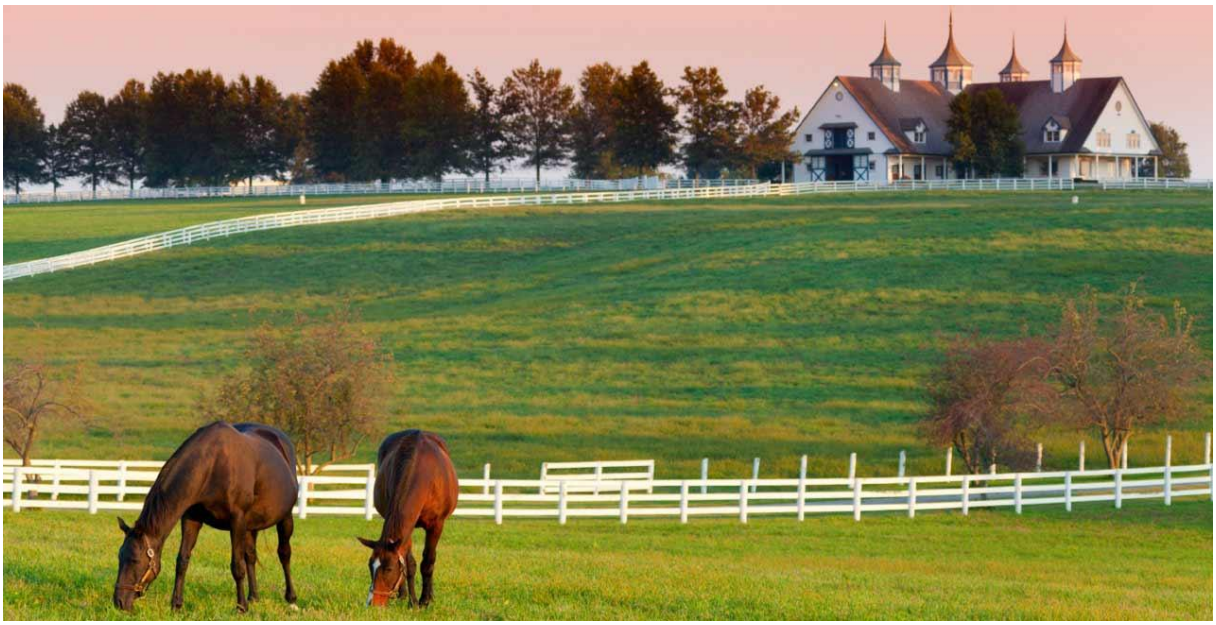

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Sedona C - 3rd Floor
Sedona D - 4th Floor
Arizona Grand Pkwy
Pointe Pkwy West
Sedona
Sierra Ballroom
Conference Center
Sonoran Patio
Sonoran Sky Ballroom
Camelback Patio
Paseo East
Paseo
Camelback A - 1st Floor
Camelback C - 3rd Floor
Camelback D - 4th Floor
Camelback F - 6th Floor
Camelback
Oasis Water Park
Oasis Pavilion
Oasis Slide Tower
Villas
Resort Lobby
Golf Pro Shop
Mountainside
Golf Island Green
Lake
Golf Course
Lap Pool
Athletic Club & Spa
The Vista
STOP
STOP